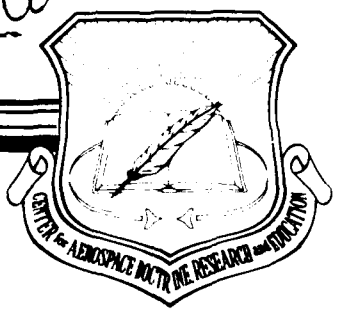
Quality Improvement

Does the Air Force Systems Command Practice What It Preaches



John A Campbell, Major, USAF

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The objective of this study is to determine if Air Force Systems Command (AFSC) acquisition personnel are aware of and using those techniques that more effectively identify nonconformances and are applying techniques to reduce incidences of nonconformance. Major Campbell uses a questionnaire. He surveys program directors, program managers, and quality assurance personnel at the AFSC's five major product divisions.

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Quality Improvement

Campbell

Does the Air Force Systems Command Practice What It Preaches?

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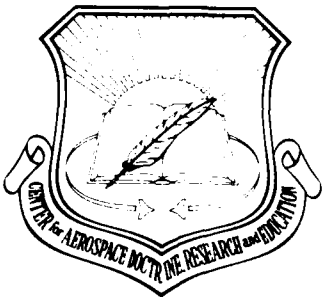

Research Report No. AU-ARI-88-13

Quality Improvement

Does the Air Force Systems Command Practice What It Preaches?

by

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Air University Press
Maxwell Air Force Base, Alabama 36112-5532

March 1990

DISCLAIMER

This study represents the views of the author and does not necessarily reflect the official opinion of the Air University Center for Aerospace Doctrine, Research, and Education (AUCADRE) or the Department of the Air Force. This publication has been reviewed by security and policy review authorities and is cleared for public release.

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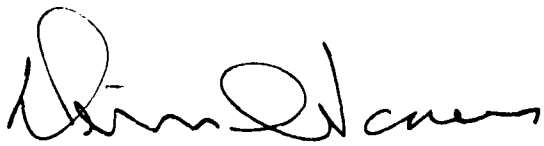
Foreword

Production inefficiencies in many defense industries have resulted in significant cost growth for major weapon systems. These costs have not gone unnoticed. The Department of Defense (DOD) has implemented many programs in an attempt to reduce these inefficiencies, but these efforts have met with little apparent success. More recently the Defense Department has adopted a philosophy—total quality management—that could finally lower these costs. This approach will require a reeducation and cultural change of both the DOD and contractor work forces.

In this study, Maj John A. Campbell uses a survey questionnaire to determine to what degree the Air Force Systems Command (AFSC) acquisition work force understands what is causing these production inefficiencies and if it is applying management techniques that can reduce the cost of these inefficiencies. He surveys program directors, program managers, and quality assurance personnel at AFSC's five major product divisions.

The most significant result of this study is that it establishes an important baseline that we can use to measure our commitment to addressing these production inefficiencies. The data strongly supports the notion that the total quality management philosophy using continuous improvement is not well understood by the acquisition work force. The data also indicates that the work force does not understand the magnitude of these production inefficiencies. Finally, a communication problem in the program offices inhibits the work force from applying those management techniques that can minimize these inefficiencies.



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About the Author

Maj John A. Campbell completed this study while assigned as the Air Force Systems Command's (AFSC) research fellow for 1987-88 to the Airpower Research Institute (ARI), Air University Center for Aerospace Doctrine, Research, and Education (AUCADRE). Major Campbell is a native of Mt. Hope, West Virginia. He enlisted in the Air Force in 1970 and served as a medical service specialist until he was selected to participate in the Airman Education and Commissioning Program. He received his BS degree in industrial engineering from West Virginia University in 1974 and earned his commission through Officer Training School in 1975.

Major Campbell was selected by the Air Force Institute of Technology (AFIT) to attend Texas A&M University, where he earned an MS degree in industrial engineering in 1980. He was selected to continue his education and obtained a doctor of engineering degree in 1983 and subsequently served on the AFIT faculty. Major Campbell is a graduate of Squadron Officer School and Air Command and Staff College in residence.

While on the AFIT faculty, Major Campbell served as the deputy program manager and program manager of the Graduate Contracting and Manufacturing Management Program, which emphasized major system acquisitions within the Defense Department. He was also assigned to the Directorate of Operations and Plans where he was responsible for AFIT's resident and nonresident (Civilian Institutions) graduate education programs. Major Campbell was assigned to the Office of the Deputy for Contracting and Manufacturing at Los Angeles AFS, Los Angeles, California. He served as the manufacturing engineer on the navigation satellite timing and ranging global positioning system (NAVSTAR-GPS) program office, working both satellite and avionics systems. While serving on the AFIT faculty, he performed consulting services for the GPS, F-16, C-17, and low-altitude navigation and targeting infrared for night (LANTIRN) system program offices. Following his tour as Headquarters AFSC's research fellow within the Airpower Research Institute, Major Campbell was assigned to the Directorate of Manufacturing and Quality Assurance, Deputy for B-2 Aeronautical Systems Division, Wright-Patterson AFB, Ohio.

Preface

My charter from Col Robert J. Pratt, director, product assurance engineering in the Office of the Deputy Chief of Staff, Product Assurance and Acquisition Logistics, Headquarters Air Force Systems Command, was to determine how well the acquisition work force understands and is using total quality management (TQM). Over the last two decades some 20 major studies have made hundreds of recommendations on how to improve the quality assurance function. Many of the recommendations have been implemented, but critics still say the quality of Defense Department products is not as good or as cost effective as it should be.

I have tried to structure this document for two categories of readers: the senior management personnel interested in key issues, findings, and recommendations and the acquisition personnel interested in improving the quality and reducing the cost of our systems. The senior managers should read chapter 1 (Introduction), chapter 2 (Quality Assurance: A Survey of Previous Studies, the first two sections, Introduction and Overview), and chapter 5 (Summary and Recommendations). The rest of the acquisition work force should read all five chapters. Chapter 1 identifies the problem. Chapter 2 reviews six major quality studies conducted during the last 10 years and provides the background for this study. Chapter 3 describes the research methodology used in this study, and chapter 4 presents the survey data gathered during this study. Chapter 5 outlines the conclusions and proposes recommendations to improve quality and productivity in major system acquisitions.

I cannot mention all of the individuals who aided and encouraged me in the course of this project. I would like to thank Maj Gen David J. Teal for the interest and support he provided in this study. I would like to especially thank all the senior program directors, program managers, and quality assurance personnel who took the time to complete my survey questionnaire. I owe special thanks to Lt Col Robert Bienvenue, Maj George Noyes, and Grover Cleveland for all the time and effort they most readily gave in support of this study.

The people at the Air University Center for Aerospace Doctrine, Research, and Education have been superb. A special thanks goes to Lt Col Manfred Koczur, who always went beyond his duties to ensure that the researchers had everything required to do the research. This study would not have been possible without his assistance in getting supplies, computers, and plotters. Another special thanks goes to my committee chairman, Dr Stephen Blank, who provided the right combination of guidance and freedom to allow me to perform this study. I cannot thank Thomas C. Lobenstein enough for going beyond his editorial duties to help structure and ensure the

readability of this document. I would also like to thank that small group of other command-sponsored research fellows who were always there providing the support and encouragement needed to complete this project. I would be remiss if I did not thank Jesse Barron and Judy Lacour, 1973d Communications Group, for all the help they gave in writing the interface with the Statistical Package for the Social Sciences-X (SPSS-X) programs. Their assistance was invaluable for this study.

Finally, I must acknowledge the special contributions of my family. My wife Pat's love and support long distance from Ohio make her the most significant contributor to this project. I could never adequately express in words my appreciation for her dedicated support. I must give a special thanks to my son Keith who understood why dad had to go to Alabama for a year and miss some of the important moments in his teenage life. I will always be grateful to my family and special friends for their love, support, and encouragement.

John A. Campbell

JOHN A. CAMPBELL, Maj, USAF
Research Fellow
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CHAPTER 1

Introduction

During the last several years the press, Congress, and even people inside the Department of Defense (DOD) have strongly criticized the way the armed services develop and acquire new weapon systems and related hardware. Much of this criticism has focused on highly publicized examples of mismanagement and waste such as $700 toilet seats and $7,000 coffee makers. The Defense Department, in recognizing these problems, has applied much energy and resources to solving any problems that exist. As a result, charges of the Defense Department paying exorbitant prices are now rare. However, such articles have been replaced with highly critical ones focusing on cost growth, late deliveries, and unreliable and poor quality systems. Examples include several months' delay in the delivery of the advance technology bomber (B-2),[1] poor reliability of the Maverick and Phoenix missiles, and delivery of the newest intercontinental ballistic missile (ICBM), the Peacekeeper (MX), with poor quality parts in its guidance system. In addition to the press, some very high ranking DOD officials have been critical of how the armed services are managing weapon acquisition.

In a 1982 Defense Logistics Agency productivity seminar, Gen Robert T. Marsh, then commander of Air Force Systems Command (AFSC), said that US defense industries needed a "quality revolution." He estimated that AFSC alone was wasting "a minimum of $570 million a year on scrap, rework and repair at the prime contractor's plant."[2] He further estimated that these "hidden factory" costs have increased 60 percent since 1976. That same year Sen John W. Warner (R-Va.), speaking at a quality and productivity conference, estimated these hidden factory costs to be as high as 15 percent of the defense procurement budget and announced he was planning to sponsor hearings to investigate these costs.[3]

Robert B. Costello, under secretary of defense for acquisition, stated in February 1988 that because of red tape and production inefficiencies the government was losing as much as $45 billion "of the yearly military purchasing budget."[4] These production inefficiencies are the same hidden factory costs referred to by General Marsh and Senator Warner in 1982. Costello went on to say that this loss amounted to about 20 to 30 percent of the $150-billion total procurement budget and *was not adding any value* to the weapon system.[5] Further emphasizing a need for improvement, a poll reported by the *AIR FORCE Magazine* stated that "a majority of citizens

believes that the government is being cheated left and right in military procurements."[6] This lack of faith by US taxpayers can have a serious impact on how the Defense Department maintains combat readiness through acquiring new weapon systems.

The Defense Department has the responsibility and obligation to the taxpayer to acquire only those systems required for national security, and in the most cost-effective and efficient manner possible. But, if DOD continues not to address these hidden factory costs, Congress will focus its attention on that problem, as it has in many other instances, and will be justified in providing a solution to it. Congress not only responds to obvious problems of mismanagement and waste but to the concerns of its constituents. Hence, in the last few years Congress has become increasingly involved in overseeing the management of DOD weapon systems. This oversight may come in the form of reduced budgets, new legislation to fix the problem, or increased "micromanagement," namely, requirements to report directly to Congress. Many in DOD debate the value of some of these congressionally imposed fixes because they require additional reporting to Congress. This reporting requirement has significantly increased the work load for what many say is an already overburdened acquisition work force. A recent example of congressional concern with DOD program management was the authorizing of $10 million to be used specifically to develop a cost control management program for the advanced technology bomber (B-2).[7] This move was a result of many articles and reports of significant cost overruns on the program.

The Competition in Contracting Act of 1984 (PL 98-369) was another example of Congress trying to ensure that the Department of Defense introduces more competition into its procurement practices. For many years Congress had felt that the Defense Department and other federal agencies had not been awarding contracts in a fully competitive environment. Basic economic theory says that in a free-market environment, competition will reduce the price of an item. As a result of this new law more than one-third of the *Federal Acquisition Regulation* (FAR), which was only one year old, was revised. FAR, which became law in 1983, consolidated the procurement procedures of all federal agencies into one regulation; it specified how all federal agencies would procure items. This consolidating of procurement procedures has had tremendous impact on many federal agencies and contractors.

The *DOD Supplement to the Federal Acquisition Regulation* was yet another step by Congress to try to make the suppliers of major weapon systems more responsible for the products they sell the government. Many in Congress believed that contractors were not providing as reliable a product as possible. Congressional critics thought that DOD contractors should warrant their products similar to the way many commercial

products are warranted. Thus, *DOD FAR Supplement*, Part 46.770-2, Policy, stated:

> Unless waived under 46.770-9, after 1 January 1985, the Military Departments and Defense Agencies may not enter into a contract for the production of a weapon system . . . unless:
>
> (1) a prime contractor for the weapon system provides the United States with written warranties.

DOD FAR Supplement, Part 46.770-9, required that a copy of any waiver be submitted to the Senate and House Committees on Armed Services and on Appropriations. This requirement was an obvious example of Congress becoming more involved in how DOD manages its weapon system acquisitions and, in so doing, increasing the burden of reporting.

In the 1986 DOD Authorization Act (PL 99-145), Congress stipulated that certain acquisition personnel have specific training and education. Section 1624 required mandatory training for all personnel responsible for assuring quality in contractor facilities. Again, Congress believed that many of the quality assurance personnel responsible for accepting DOD products had not been adequately educated or trained to perform this function.

Reducing hidden factory costs and increasing the skills of acquisition personnel in quality improvement became even more important in view of recent trends in the defense budgets. During the early 1980s, the Defense Department was able to obtain increasing budgets and made significant strides in increasing the capability of the armed forces. However, the trend for the future indicated a decreasing procurement budget (table 1). If this downward trend were to continue, as it did in the late 1970s, the state of readiness of our military forces could again be seriously threatened. In 1980 the General Accounting Office (GAO) reported to Congress that the rising cost of weapon systems resulted in the acquisition of fewer units of equipment than needed by the armed services, which affected their combat readiness. There was little doubt that the cost of weapon systems would continue to increase. Given the shrinking procurement budget as indicated using costs of weapons, the Defense Department should expect lean budget years ahead. Therefore, DOD must become more effective and efficient in procuring material. Not to do so could have serious consequences on our national security.

This research project evaluated how well Air Force Systems Command quality assurance (QA) personnel, program directors (PD), and program and project managers (PM) understand what hidden factory costs are and determined whether those workers were performing the necessary functions to reduce them. When General Marsh discussed hidden factory costs, he was addressing primarily scrap, rework, and repair costs. These three factors served as primary indicators of a product's quality[8] and were the major focus of this research project.

TABLE 1

Procurement Budget
(Millions)

	FY 86	FY 87	FY 88
Department of Defense	$92,506	$80,234	$81,027a
Air Force	37,100	34,893	32,534b
Air Force Systems Command	19,129	13,557	11,174c

a. *Annual Report to the Congress, Fiscal Year 1989* (Washington, D.C.: Government Printing Office, 11 February 1988), 297.

b. *Defense Budgets* (Washington, D.C.: Government Printing Office, 11 December 1987), F-i.

c. Rita Maldonado, budget analyst, Budget Management Division, Deputy Chief of Staff, Comptroller, Headquarters Air Force Systems Command, Andrews AFB, Md., telephone interview with author, 10 February 1988.

Quality Regulations

Four primary documents define and regulate what actions the Air Force will take to assure quality in its acquisitions. These documents are the *Federal Acquisition Regulation*, Part 46.105, Contractor Responsibilities; the *DOD Supplement to FAR*, Part 46.102, Policy; DOD Directive 4155.1, *Quality Program;* and AFR 74-1, *Quality Assurance Program.*

Federal Acquisition Regulation

The *Federal Acquisition Regulation* sets the policy and requirements for quality assurance in government procurements. FAR, Part 46.105, states:

> (a) The contractor is responsible for carrying out its obligations under the contract by—
>
> (1) Controlling the quality of supplies or services; [and]
>
> (2) Tendering to the Government for acceptance only those supplies or services that conform to contract requirements.

DOD Supplement to the Federal Acquisition Regulation

The *DOD Supplement to FAR* identifies specific requirements expected of the Defense Department concerning the contractor's responsibility for delivering quality products. Part 46.102 (72)(2) states:

> The Government shall hold contractors responsible for the quality of products and services by means of:
>
> (i) contract provisions that place responsibility on contractors;
>
> (ii) the Government's exercising its right to reject or return contractor-responsible defective items for repair, correction or replacement.

DOD policy is that the manufacturer has ultimate responsibility for producing quality products. This policy is set forth in DODD 4155.1 and applies to all DOD components.

DODD 4155.1, *Quality Program*

DODD 4155.1 requires all DOD components to ensure that all services and products acquired conform to specified requirements. DOD's stated policy in this directive repeats the requirements of DOD FAR Supplement, Part 46.102 (72)(2): the "contractor shall be held responsible for the quality of products and services." However, this directive goes on to say that contractors are to be held responsible for the quality of their suppliers and vendors. It further states that DOD components will not award contracts to contractors who have a history of delivering poor quality products or services. This directive also places requirements on DOD components to maintain a quality history on the contractor and a product deficiency reporting system that can be used to evaluate a contractor. Additionally, it makes the program (system) manager responsible and accountable for assuring that products or services delivered to the Department of Defense are of acceptable quality. One final important requirement of this directive is that it requires the program (system) manager to quantify quality characteristics whenever possible.[9]

AFR 74-1, *Quality Assurance Program*

The Air Force implements this DOD policy through AFR 74-1. This regulation specifies the objectives of the Air Force quality assurance program. Some of the Air Force's objectives include making sure that all products and services conform to specified quality requirements. These specified requirements must be practical, enforceable, and necessary. Quality deficiencies that affect the mission and user satisfaction must be prevented and action must be taken to eliminate the causes of these deficiencies. Air Force policy emphasizes preventing quality deficiencies and recurrence of those conditions which cause deficiencies. Additionally, data from the users of the products and services acquired will be analyzed to assess and improve the quality assurance program. The regulation also requires that QA people participate in design reviews throughout all acquisition phases.

On major programs, quality assurance personnel are to perform independent quality assessments throughout the system's life cycle. This process will be an objective evaluation of program adequacy from a quality viewpoint to verify that quality characteristics are quantified and, when possible, specified and designed into the product. The directives also list functional requirements for the contracting organization, contracting administration organization (CAO), and the major commands (MAJCOMs). The contracting organization must ensure that contracts include inspection

and acceptance provisions; it must maintain data concerning unsatisfactory products; and it will not award contracts to contractors who deliver poor quality products. The CAO must ensure that the contractor complies with the contract quality before accepting the product, must maintain historical information on the contractor's quality performance, and may reduce surveillance when the contractor's quality performance justifies doing so. The MAJCOM will plan, program, and budget for adequate manpower resources to ensure an effective QA program, evaluate the quality of products at regular intervals, and ensure that QA personnel are properly trained and motivated. Finally, the regulation identifies QA tasks to be performed during each acquisition phase.[10]

These regulations are the primary documents that establish policy and provide guidance to the DOD and Air Force on how to procure quality products. By law (FAR), the contractor must deliver a product that meets the quality requirements specified in the contract. Contrary to the results of the opinion poll reported by *AIR FORCE Magazine*, contractors are not out to cheat DOD. Alan C. Chase, a professional staff member of the House Armed Services Committee, says that these impressions (cheating DOD) are driven more by belief than by fact. He also said that he "has not found reason to question the integrity of the defense industry as a whole."[11]

Much of the problem arises from the difficulty that the work force has in specifying measurable parameters of quality for complex state-of-the-art equipment. A short story written by John Guaspari, titled *I Know It When I See It: A Modern Fable about Quality*, clearly demonstrates this point. The premise of this story is that sometimes quality is difficult to put into words but the buyers know quality when they see it. This book discusses a fictional company that made paper products. The company begins to lose customers even though its product met their specifications. The point of the story is that the customer has needs that must be met, and those are not necessarily the same as the specifications.[12] A recently published handbook by Headquarters AFSC identifies many management indicators that will be very helpful to the work force in assessing the health of a program.[13]

AFR 74-1 defines quality as: "The composite of material attributes including performance; features and characteristics of a product or service to satisfy a given need." The idea of satisfying the need parallels the thesis of Guaspari's story. Although it is important to identify specific requirements for quality to the contractor, the final factor must be how well the product satisfies its intended use. This fitness for use is becoming the working definition of a quality product for many acquisition personnel in AFSC. Most products and services used by the Air Force are acquired by Air Force Systems Command (AFSC) and Air Force Logistics Command (AFLC). This research focuses on how AFSC ensures that the Air Force receives a quality product.

Mission of Air Force Systems Command

The Air Force Systems Command is responsible for acquiring most weapon and related systems in the Air Force inventory today. Specifically, AFSC has three primary responsibilities: to advance aerospace science and technology; to adapt these advances into developing and improving operational systems; and to acquire qualitatively superior, logistically supported aerospace systems at the most effective cost.[14] AFSC controls more than one-third of the total Air Force budget. Most of AFSC's share of this budget goes toward research, development, testing, and hardware procurement. Systems Command continuously seeks better, more efficient techniques of managing the resources devoted to national defense.

To accomplish its mission, Air Force Systems Command is organized into buying (product) divisions, test centers, a contract management division, and others. This study focuses on quality assurance at the buying divisions but must discuss the mission of the Contract Management Division, Kirtland AFB, New Mexico, because of its responsibility for quality assurance. The product divisions are the Armament Division (AD), Eglin AFB, Florida; the Aeronautical Systems Division (ASD), Wright-Patterson AFB, Ohio; the Ballistic Missile Office (BMO), Norton AFB, California; the Electronic Systems Division (ESD), Hanscom AFB, Massachusetts; and the Space Division (SD), Los Angeles AFS, California. The buying divisions are organized into program offices where in most cases the quality assurance personnel are integrated into that organization.

Air Force Contract Management Division

The Air Force Contract Management Division (AFCMD) is the primary Air Force agency responsible for contract management functions at contractor plants assigned to the Air Force by DOD. The division performs these functions for government program managers and buying agencies and evaluates the contractor's management systems, practices, and contract performance.[15]

AFCMD's 4,000 military and civilian personnel perform contract management at 24 plants throughout the United States. These Air Force plant representative offices (AFPROs) have an average of about 155 personnel assigned, but this number ranges from approximately 300 at large plants to 60 at small plants. About 39 percent of these AFCMD personnel are responsible for the quality assurance function, including inspection.[16] The other personnel provide contract management services in manufacturing operations, subcontract management, industrial materiel management, contract payment, and engineering and program support.[17] Until just recently, AFCMD primarily used the contractor management system evaluation program (CMSEP) to evaluate the contractor's performance in the above mentioned areas. CMSEP used 307 questions to evaluate the adequacy of and compliance with the contractor's documented manage-

ment systems. The largest number of questions (67) were dedicated to the quality assurance function. The Air Force's philosophy of using CMSEP for contract management was that if the contractors' systems are adequate and comply with their own procedures, then the product should be good. The results of these evaluations were provided to the government program managers and buying agencies. However, many AFCMD officials have questioned the effectiveness of this system for several years,[18] and the division has recently decided to discontinue using CMSEP as its primary contractor performance tool.

Armament Division

The Armament Division conducts planning, research, development, test, evaluation, and initial acquisition of nonnuclear armament. It also conducts development and acquisition for improved range and instrumental systems. The division is the center of expertise for conducting tests for all acquisition phases on such systems as nonnuclear munitions, armament avionics, and radiating systems and for conducting tests of flightworthiness.[19] The Armament Division has a total of 13 military and civilians assigned to perform the quality assurance function.

Aeronautical Systems Division

The Aeronautical Systems Division plans and manages the development and acquisition of aeronautical systems, subsystems, and equipment, including in-flight test and evaluation. The division provides airborne test-beds and airborne range instrumentation services to support AFSC organizations, DOD agencies, the National Aeronautics and Space Administration (NASA), and the Federal Aviation Administration.[20] ASD has 66 military and civilian personnel assigned to the quality assurance function.

Ballistic Missile Office

The Ballistic Missile Office plans, implements, and manages programs to acquire ballistic missile systems, subsystems, and equipment. BMO also manages the alteration of missile sites and launch facilities.[21] BMO has 12 military and civilian employees assigned to the quality assurance function.

Electronic Systems Division

The Electronic Systems Division plans, manages, and conducts technological development (including research and exploratory, advanced, and engineering development), acquisition, logistics support planning, installation, and delivery of command, control, communication, and intelligence (C^3I) systems and ground electronic systems.[22] ESD has approximately 60 military and civilian employees assigned to the quality assurance function.

Space Division

The Space Division plans, programs, and manages projects to acquire space systems, subsystems, and equipment. The division provides for the maintenance, construction, or alteration of launch, tracking, and support facilities; conducts launch and flight-test and evaluation support; and performs launch, on-orbit satellite tracking, data acquisition, test and evaluation, and command and control of DOD satellites.[23] The Space Division has 43 military and civilian employees assigned to perform the quality assurance function at Los Angeles AFS.

Research Objective

As noted earlier, AFSC has always sought more efficient and effective methods to acquire weapon systems. AFSC has sponsored more than a dozen research projects over the years, many of which have focused on improving the quality assurance function. These studies have led to many significant changes to the way quality assurance is performed in AFSC. The primary reason for doing this research is to see if AFSC acquisition personnel are focusing their attention properly on the hidden factory costs described earlier by General Marsh.

More specifically, the objective of this research project is to determine how well AFSC acquisition personnel are performing those tasks that can effectively control and reduce those hidden factory costs. Although these costs exist throughout DOD, this research project is limited to AFSC. This research problem consists of finding answers to six basic research questions.

1. What research projects and studies addressing product quality have been performed in the past?
2. What are the most important factors affecting productivity and quality?
3. What is the SPO doing to affect quality?
4. What is the contractor doing to affect quality?
5. To what extent are indicators of quality used?
6. To what extent are SPO personnel using the cost of quality as a program management concept?

The answer to these questions will provide AFSC an indication of how well the command is addressing hidden factory costs.

Notes

1. Eileen White Read, "Northrop Gets Stealth Award, Sources Say," *Wall Street Journal*, 25 January 1988, 7.
2. Philip J. Klass, "Quality Draws Key Focus At Productivity Seminar," *Aviation Week & Space Technology*, 14 June 1982, 109.

3. Ibid.

4. Charles W. Corddry, "Up to $45 Billion of Military Purchasing Goes to Waste, Defense Official Complains," *Baltimore Sun*, 11 February 1988, 16.

5. Ibid.

6. John T. Correll, "Industry Under the Gun," *AIR FORCE Magazine*, November 1985, 68.

7. Read, 7.

8. Deputy Chief of Staff, *Product Assurance and Acquisition Logistics, Product Assurance and Acquisition Logistics Management Indicator Handbook* (Andrews AFB, Md.: Headquarters AFSC, April 1987).

9. DODD 4155.1, *Quality Program*, 10 August 1978.

10. AFR 74-1, *Quality Assurance Program*, 1 June 1979.

11. Correll, 69.

12. John Guaspari, *I Know It When I See It: A Modern Fable about Quality* (New York: American Management Association, 1985).

13. *Product Assurance Handbook*.

14. *Air Force Systems Command* (Andrews AFB, Md.: Headquarters AFSC), foreword.

15. AFSCR 23-16, *Air Force Contract Management Division (AFCMD)*, 23 May 1986, 1.

16. Brig Gen Ken Johnson, "Accountable Contract Management, AFCMD Review" (Andrews AFB, Md.: Headquarters AFSC, August 1984).

17. AFSCR 23-16, 1.

18. General Accounting Office, "Quality Assurance, Efforts to Strengthen DOD's Program" (Washington, D.C.: November 1986), 6.

19. AFSCR 23-7, *Armament Division*, 12 September 1985, 1.

20. AFSCR 23-3, *Aeronautical Systems Division (ASD)*, 22 May 1986, 1.

21. AFSCR 23-19, *Ballistic Missile Office (BMO)*, 7 May 1987, 1.

22. AFSCR 23-10, *Electronic Systems Division (ESD)*, 6 February 1987, 1.

23. AFSCR 23-9, *Space Division*, 10 May 1984, 1.

CHAPTER 2

Quality Assurance: A Survey of Previous Studies

Approximately 30 studies, dated back to 1962, have addressed problems in the Department of Defense (DOD) quality assurance programs. Six recent research studies have direct application to how the Air Force Systems Command (AFSC) performs the quality assurance function. These studies provide the necessary background to develop the scope and methodology for the current study. Headquarters AFSC commissioned these six studies, conducted during the last 10 years, to seek solutions to problems the command was experiencing in the quality of the products it was acquiring.

A comprehensive 1977 study set the standard research methodology for the studies that followed. Each study team reviewed findings and recommendations of previous studies and reviewed DOD and Air Force policies and regulations concerning quality. Most study groups conducted interviews with high-level acquisition personnel in the DOD, the service departments and headquarters, the service acquisition headquarters, contract administration organizations, contractors, and professional organizations. The study teams gathered data using surveys administered to various acquisition personnel. The average study lasted six to 12 months and involved approximately 10 personnel from many acquisition backgrounds, including several general officers.

These studies made many important recommendations and led to several changes in how the Air Force performs its quality functions. One significant change recommended by the *Quality '77*[1] (1977) and *Quality Horizons*[2] (1979) studies was creating the office of Deputy Chief of Staff, Product Assurance and Acquisition Logistics (HQ AFSC/PL), to oversee the quality function. This action elevated the level of importance of the quality assurance function. Another recommendation by these studies resulted in significantly increasing the size of the QA work force at the five product divisions. The *Accountable Contract Management, AFCMD Review* (1984), recommended that at least 100 personnel were needed in the buying divisions to ensure that quality and producibility received its proper attention in the design phase.[3]

Each of these studies identified a lack of training for the QA personnel as a major deficiency. They recommended mandatory training programs, specific training courses for the Air Force Contract Management Division (AFCMD) personnel, intern programs, and on-the-job-training (OJT)

programs. These three studies and two others, *Contract Incentives for Product Quality* (1980)[4] and *Project Quality* (1982),[5] recommended that the Air Force use more contract incentives to motivate the contractor to deliver better quality products. Four of the studies—*Quality '77*, *Quality Horizons*, *Project Quality*, and *Accountable Contract Management, AFCMD Review*—also concluded that AFSC needed a policy or regulation that clearly specifies that quality has a high level of importance in the acquisition process. The current commander of AFSC, Gen Bernard Randolph, recently issued a policy statement[6] and a letter[7] stressing the priority of quality in AFSC.

Three studies—*Quality '77*, *Quality Horizons*, and *Quality Assurance: Efforts to Strengthen DOD's Program* (1986)[8]—specifically recognized the need for the Air Force to enforce its quality requirements and make contractors more responsible for the quality of their products. Furthermore, all six studies undertaken during this 10-year period identified the need for the government to use indicators of quality data to assess and manage contractors. The Government Accounting Office (GAO) in its 1986 study, *Quality Assurance: Efforts to Strengthen DOD's Program*, was very critical of the Defense Department's and the Air Force's lack of use of this data.[9]

Quality '77

Maj Gen James W. Stansberry, the AFSC deputy chief of staff for [illegible] and manufacturing (AFSC/PP), commissioned the *Quality '77* study in March 1977. He expressed several concerns. Among others he noted that the QA work force had received little management attention over the years, that no manning baseline existed for the QA effort, and that programs were experiencing quality problems. He tasked Col Micheal Nassr, director of manufacturing at Headquarters AFSC, to evaluate the management and effectiveness of manning, training, methods, regulations, contractual requirements, specifications, and overall command management philosophy of the QA function.

As previously mentioned, *Quality '77* set the standard for many studies to follow. A team of about 10 AFSC personnel made a comprehensive review of 20 reports dating back to 1962. A few of the common findings from those reports are listed below and can be used to measure how many changes have been incorporated into the quality assurance function:

- QA not considered at technical reviews.
- Too few military personnel assigned to quality.
- A manpower baseline not set.
- Measurements of quality not specified.
- Contractual incentives for reducing failure costs not utilized.
- Inspection subcontractors too specific and too often duplicated.
- Contract administration organizations (CAO) too often base QA on contractor performance.

The study team also compiled and reviewed a comprehensive list of Department of Defense (DOD) and Air Force policies and regulations on quality assurance. They interviewed more than 100 DOD, Air Force, and industry personnel at various levels, including the Office of the Secretary of Defense (OSD), buying organizations, and CAOs.

The *Quality '77* team concluded "that quality assurance lacked adequate leadership and suffered from a poor image within the command. Furthermore, personnel manning the function need a stronger career development program."[10] The team made 11 primary and six secondary recommendations. The major findings were:

1. Contractors must be held responsible for the quality of their products and the government must enforce its requirements for quality. More use of contractual rewards and penalties was needed to motivate the contractor to produce quality products.
2. AFSC had no clear policy statement on the role of quality. A command policy was needed that identifies contractual requirements; states contractor and government responsibilities; and lists of quality assurance tasks.
3. The QA function was buried as a subordinate organization in the Directorate of Contract Management at Headquarters AFSC. The assurance disciplines needed to be integrated into one functional organization called product assurance, reporting directly to the DCS for procurement and manufacturing.
4. Neither the contractor nor the government was using quality cost indicators as a management tool even though contractually required on most major programs. The Air Force Contract Management Division (AFCMD) and the system program offices (SPO) needed to develop a total quality cost management program.
5. AFSC had no disciplined program to measure a contractor's quality performance to collect the kinds of data that could be used to determine the contractor's performance.
6. Because of the lack of top management's attention, the current QA work force lacked the necessary skills to accomplish the QA mission. Training and career development for both military and civilian workers in the quality assurance disciplines required immediate attention.
7. QA tasks needed to be identified no later than the acquisition phase by the system program office and contract administration organization and should be used by manpower to develop a QA manning baseline.[11]

Quality Horizons

Gen Alton D. Slay, commander, Air Force Systems Command, concerned with the significant reduction in the QA work force and impressive advances in aerospace technology, commissioned the *Quality Horizons* study in November 1978. He tasked Col Bernard L. Weiss, deputy for contracting

and manufacturing, Aeronautical Systems Division (ASD), to determine if AFSC was using the best approach to ensure quality products. The study examined the following four areas:

1. Contractor responsibility for end-item quality and reducing government in-plant presence.
2. Contractual relationships that would better place the responsibility for quality with the contractor.
3. The qualifications and any changes required of the AFSC quality assurance work force.
4. The proper QA organization and structure for AFSC.

The study team consisted of about 10 people representing Headquarters AFSC, AFCMD, and the product divisions. The team visited several DOD acquisition organizations and the governments and firms in five different countries. A few important observations were:

- Product quality is a function of top management's interest in quality.
- Successful government and industrial organizations blend the assurance sciences.
- Quality can not be inspected into the product, yet AFSC places more resources and emphasis on conformance verification than on design, process control, and test planning.
- Program managers do not want reduced in-plant surveillance.

A few of the primary recommendations made to the AFSC commander are:

- AFSC needs a product assurance policy requiring government and top industry management personnel to ensure that proper emphasis is given to the product assurance function. Executive-level training programs will be required to show the benefits and risks of product assurance programs.
- The product assurance functions should be consolidated into one organization at the headquarters and product divisions.
- Formal training and intern programs for the product assurance function need to be institutionalized.
- More use of contractual techniques to motivate the contractor to provide better quality products is needed.
- AFSC needs to implement minimum in-plant surveillance (MIPS) program to reduce government surveillance with those contractors who supply high quality products.[12]

In January 1980 General Slay endorsed five key recommendations.

1. Quality needs more emphasis from top management in AFSC.
2. Quality must be stressed up front in the design phase.
3. AFSC's quality assurance work force must be strengthened.
4. Contract incentives could be used to enhance quality.

5. Quality could be improved by proper organizational placement within AFSC.[13]

Contract Incentives for Product Quality

The Air Force Business Research Management Center (AFBRMC), Wright-Patterson AFB, Ohio, contracted for a study in August 1979 to examine motivational aspects of the US Air Force contracting techniques, focusing specifically upon QA and reliability policies and management techniques and practices. International Technology Corporation, Satellite Beach, Florida, performed this 10-month study by first conducting a thorough literature review of current quality and reliability policy and regulations. The study team then interviewed many high-level DOD and industry acquisition personnel and sent out a questionnaire to obtain an industrywide viewpoint on quality and reliability policy.

International Technology concluded that three major QA policy and motivational voids existed in the Air Force. First, the Air Force was not maintaining data to evaluate a contractor's quality performance in developing and producing major systems, although DODD 4155.1, *Quality Program*, and AFR 74-1, *Quality Assurance Program*, both precluded awarding contracts to firms producing unsatisfactory quality. An objective methodology, reproduced in appendix A, was developed to give AFSC personnel a simple set of criteria by which to evaluate a contractor's quality performance. Second, the Air Force had not developed a methodology to utilize profit motivation in the QA program. The study recommended that cost-plus, award-fee (CPAF) contracts be used to motivate contractors to improve quality products. A sample award-fee plan, reproduced in appendix B, was developed for AFSC personnel to use as a guide. Third, the *Defense Acquisition Regulation* (DAR), which preceded the *Federal Acquisition Regulation* (FAR), lacked motivational considerations for junior and nonsupervisory personnel who could directly influence product quality through attention to detail. The study recommended and proposed four changes to the DAR to provide improved methods to motivate contractor employees.[14]

Project Quality

Gen Robert T. Marsh, commander, AFSC, expressed his concern that manufacturers were attempting to "inspect in" quality after production rather than designing it into the product. The result was that AFSC has invested heavily in source inspection systems and scrap, rework, and reinspection facilities. The cost of maintaining the personnel and equipment to perform these tasks in what General Marsh called "hidden factory" costs could no longer be tolerated by the Defense Department.

In September 1982 he assigned Anthony J. DeLuca, principal assistant in the DCS, Contracting and Manufacturing (HQ AFSC/PP), as the project director. His charter was to determine what caused these hidden factory costs and to devise contractual procedures to motivate contractors to reduce these "wasteful practices." The study group's recommendations are divided into six categories sequenced across the contracting cycle.

Preproposal Actions

The study group outlined 18 possible courses of action that could be implemented in the preproposal stage of the contracting process. These steps included having the contractor review proposed requirements and identify those which have adverse effect on quality; ensuring that contractors can accurately track and analyze costs of scrap, repair, retest, reinspection, and rework (SR4) data; ensuring that statistical process controls, yield rates, and manufacturing variability are analyzed and controlled; and increasing the use of award fees and allowing the contractor to "fill in" the delivery schedule that best fits the plant capability.

Specification and Statement of Work Preparation

The study team made nine recommendations as to preparing the specifications and statements of work. They included requirements for warranties, statistical process control, reviewing quality items at design reviews, and establishing rigorous reliability demonstration tests.

Negotiation

The study group recommended that government QA personnel be included in contract negotiations and that quality considerations be equal to cost, schedule, and performance in the source selection process.

Performance, Administration of Contracts

The Project Quality team made eight recommendations with respect to contract administration. These proposals included elevating quality to the same level as cost, schedule, and performance at design reviews and having quality briefed by senior contractor quality personnel. In addition, material review boards should address why a nonconforming part was produced, and the end-item user should become more involved by periodically visiting the contractor's facilities.

Policy

The study group made nine policy recommendations. It stressed the need to make quality a major consideration for contract award and emphasizing

quality early in the program development process. The study panel argued that contracts should require companies to report and track indicators of quality. Program managers should be graded on the quality of their products and should brief the status at program and commander reviews.

Other Considerations

The group recommended that quality improvement training and motivational program costs be allowed as a direct contract charge; the number and complexity of specifications be reduced; a military standard on statistical process control be written; and scrap, rework, and repair standards be developed on a commoditywide basis.[15]

Accountable Contract Management, AFCMD Review

Gen Lawrence A. Skantz, former commander, AFSC, commissioned a study in September 1984 to evaluate what the Air Force Contract Management Division's (AFCMD) role in contract management should be and how effectively the division was performing this mission. Brig Gen Ken Johnson, deputy chief of staff, acquisition logistics (HQ AFSC), was appointed as the study director. He was assisted by a very senior group of advisers including five retired general officers, an industry vice president, and an assistant secretary of the Air Force.

The study group presented seven recommendations to General Skantz. First, the study team concluded that an adversarial relationship existed between many of AFSC's product division SPOs and AFCMD's plant representative offices. At issue was the question: Is AFCMD's mission an independent check and balance on the buying division? This relationship resulted in a fundamental problem of accountability affecting quality, reliability, maintainability, and producibility of the products. To solve this problem, the study team recommended that the AFSC commander create an accountability chain from the AFSC commander to the product division's program directors and then to the Air Force plant representative offices (AFPROs). The study team also recommended that the SPO program directors should make the AFPROs their agents in the plant.

Second, the study group identified a need to upgrade the work force. The average AFCMD grade was 9.47, the turnover rate was high, and the cross flow of assignments between AFPROs and SPOs was low. The study team recommended that a career path be established that included assignment cross flow and that AFCMD establish a training center to provide the specialized skills needed.

Third, the study team observed that despite all the rhetoric of designing quality into the product the Air Force was still trying to inspect it in. Quality assurance was not as important as schedule, cost, and performance

considerations, and the integration of QA throughout the design and manufacturing process needed much more emphasis. The study group recommended that the Air Force stress to industry that quality in design is mandatory. Also, AFCMD needs to expand the use of contractor operation reviews using more SPO personnel.

Fourth, the study team noted that the Air Force has not made producibility in design a high-priority item, in fact limited government resources were devoted to this function. Most SPO engineering resources are performance oriented. The group also observed that the Air Force had no way of obtaining scrap, rework, and repair data and did not have any way of getting this data to the SPO. The study team recommended that the buying divisions needed at least 100 people dedicated to ensuring that quality and producibility get an early emphasis in the design phase. Also, it recommended that design producibility be elevated in the source selection process and that scrap, rework, and repair data be delivered to the government.

Some general comments made by the study team were that the government's hardware surveillance role was only marginally effective and incentives should be used to motivate the contractor to do the job right the first time and at least cost. If the incentive proved effective, the government should withdraw from the hardware surveillance role.[16]

Efforts to Strengthen DOD's Quality Assurance Program

In November 1985 Sen William V. Roth, Jr., chairman, Committee on Government Affairs, asked the Government Accounting Office (GAO) to investigate if weaknesses existed in the various DOD contractor surveillance programs and determine what must be done to identify and initiate changes. The GAO team reviewed many quality studies, reports, and articles and interviewed many DOD and contractor personnel. It also visited two plant representatives' offices—one Navy and one Army—to review their plans and procedures for verifying contractor compliance with contract requirements.

The GAO concluded that the in-plant quality assurance programs were not as effective as they should be in ensuring that quality products are delivered to field activities. The agency found that the plant representative offices failed to implement fully the Defense Department's *Federal Acquisition Regulation* requirements and had no comprehensive DOD-wide plan for improving the in-plant QA program. The GAO investigators showed that neither the plant representatives nor the contractors had data readily available to identify recurring contractor deficiencies even though extensive quality data existed. Additionally, government personnel were not performing all required government inspections to verify that products conformed to contract requirements. Reviews by the services and the Defense Logistics

Agency (DLA) contract administration organizations identified widespread contractor quality deficiencies.

The study recommended that the secretary of defense direct the services and DLA to implement a standardized approach for contract surveillance and to develop a long-range plan for implementing a DOD-wide plan for assuring optimum quality. This recommendation was based upon DODD 4155.1, *Quality Assurance Program*, which requires the DOD components to develop and use joint procedures for QA programs.[17]

Summary

In this chapter, the author reviews six major studies done over the last 10 years that focus on AFSC's quality assurance function. These studies serve as a foundation for this current study. The next chapter describes the research methodology used in this study.

Notes

1. AFSC Quality Assurance Study Group, *Quality '77* (Andrews AFB, Md.: Headquarters AFSC, DCS, Procurement and Manufacturing, 7 October 1977), 13–14.
2. Col Bernard L. Weiss, *Quality Horizons*, Final Report, vol. 1 (Andrews AFB, Md.: Headquarters AFSC, 15 November 1979), 59–62.
3. "Accountable Contract Management, AFCMD Review," briefing to the AFSC commander, December 1984.
4. *Contract Incentives for Product Quality*, Final Report (Satellite Beach, Fla.: International Technology Corporation, 11 June 1980), 73–74, USAF, F33615-79-C-5067.
5. Anthony J. DeLuca, *Project Quality* (Andrews AFB, Md.: Headquarters AFSC, 1982), 14.
6. AFSC Regulation 550-12, *Commander's Policies, Reliability, Maintainability, and Producibility (RM&P)*, 15 April 1988, 1–2.
7. Gen Bernard P. Randolph to AFAFSC/CC, letter, subject: Total Quality Management (TQM) in AFSC, 12 May 1988.
8. Government Accounting Office, *Quality Assurance, Efforts to Strengthen DOD's Program* (Washington, D.C.: November 1986), GAD/NSIAD-87-33.
9. Ibid.
10. History, Headquarters AFSC, Andrews AFB, Md., FY 1982, 169.
11. *Quality '77*.
12. *Quality Horizons*.
13. History, AFSC, FY 1982, 170.
14. *Contract Incentives*.
15. *Project Quality*.
16. *Accountable Contract Management*.
17. *Quality Assurance*.

CHAPTER 3

Research Methodology

The six studies discussed in chapter 2 provide background information on the status of quality management in Air Force Systems Command. They also serve as a reference point for determining how quality management might be changing. In this chapter I analyze the recommendations of these previous studies to see to what degree those recommendations were successfully implemented and to what extent deficiencies still exist.

Description of Population

The literature on total quality management suggests that everyone in the organization can influence and is responsible for ensuring a quality product. However, in this study I limit the population of interest to three groups of acquisition personnel. The first group includes the quality assurance personnel, *both managers and engineers*, whose functional responsibility is quality assurance. The second group of interest includes the program directors, who have the ultimate responsibility (referred to as program managers in DOD Directive 5000.1, *Major and Non-Major Defense Acquisition Programs*) for delivering a quality product to the user. Group three consists of the program or project managers, who work directly for the program directors managing many of the subsystems or projects.

Points of contact at each of the five AFSC product divisions identified 185 quality managers or engineers who work full- or part-time in the quality discipline on one or more programs or who work in the staff function. I surveyed the entire population of quality assurance personnel.

After trying unsuccessfully to get a list of program directors from Headquarters AFSC, I reviewed organizational charts from each product division to identify the program directors of major systems. Using the five product divisions' organizational charts that were current as of December 1987, I identified 145 system program office (SPO) program directors, deputies, or assistants. Given that the program director's decisions have a major effect on quality, I surveyed all 145 directors.

Headquarters AFSC, Deputy Chief of Staff, Manpower and Personnel (HQ AFSC/MP), provided a complete computer list of program or project managers in the rank of lieutenant colonel through second lieutenant with Air Force speciality codes 271x and 272x. The list contained 1,912 names; the majority were located at the five product divisions of interest in this

research. After reviewing the list, I reduced this subpopulation to 1,402 names by eliminating those personnel located at other bases and those with nonprogram or nonproject-management job titles.

The total population for this research was approximately 1,732 subjects: 1,402 program or project managers, 145 program directors, and 185 QA personnel. These people were located at the five product divisions in four different states.

Data Collection

Among the many ways to survey a population to collect data are personal interviews, telephone interviews, and mailed questionnaires. Although some argue that personal and telephone interviews can provide more reliable data, when samples are comparable the mode of data collection does not affect most survey estimates.[1] Personal and telephone interviews have the disadvantage of high cost, including travel time for personal interviews and time required to contact each individual. The most significant weakness of the mail survey approach is the nonresponse bias. This nonresponse bias can change the survey results significantly depending upon the percentage of those not responding and how materially different they are from the respondents and from the whole population. The size of the population, its physical dispersion in four different states, and the travel constraints imposed by this research program dictated the use of the mail survey technique. The mail survey is uniquely qualified to overcome the high cost and time required for personal and telephone interviews and also has the advantage of giving the respondents more time to collect facts, look up records, and give more thoughtful answers.[2]

I surveyed all 185 quality assurance personnel and 145 program directors. Because of the large number of program or project managers (1,402), I chose a statistically random sample, using a random number table to select 640 names from the list provided by Headquarters AFSC/MP. This sample represents approximately 46 percent of the AFSC product divisions' program or project managers. This sample size was chosen primarily for economic reasons to keep the total number of surveys mailed below 1,000. Although a larger sample gives a better estimate of the population, a sample size of about 200 would have provided a 95-percent confidence rate with a ±6 percent error that any statement made about the population from the sample mean would be true.[3] A 95-percent confidence rate with an error rate of less than 10 percent is often used to provide an acceptable level of accuracy for this data.

Table 2 shows the number of surveys mailed to each product division by each subpopulation surveyed. The response rate from each subpopulation was significantly less than expected. People do not respond to mail surveys for many reasons. One important reason is poor questionnaire design, which includes poorly written questions and too many questions that

require a great deal of time and effort to complete. Another important reason for low response rate deals with the respondent's interest in the subject. Unless one is dealing with a group of respondents who have genuine interest in the problem under investigation, know the sender, or have some common bond of loyalty to a sponsoring institution or organization, the rate of returns is frequently disappointing.[4] People respond who have a particular interest in the subject. The actual responses for each population and the estimated error for a 95-percent confidence rate are listed in table 3. Approximately 51 percent of the quality assurance personnel, 42 percent of the program directors, and 34 percent of those program or project managers surveyed responded to the questionnaires.

TABLE 2

Number of Questionnaires Mailed

	ESD	ASD	AD	SD	BMO	Total
Quality Personnel	60	65	13	36	11	185
Program Directors	37	54	12	35	7	145
Project Managers	97	367	57	77	42	640
TOTAL	194	486	82	148	60	970

TABLE 3

Responses and Estimated Error Rate

	Returns		Error Rate
	(n)	(Rate)	
Quality Personnel	94	(51%)	7%
Program Directors	61	(42%)	10%
Project Managers	217	(34%)	6%
TOTAL	372		

Because of the potential problems from low response rates, I made several attempts to assure a response rate over 50 percent. I tested the survey instrument to ensure that it was clear and concise and would take less than 30 minutes to complete. Additionally, to emphasize the importance of the topic, a letter (appendix C) from the AFSC deputy chief of staff for product assurance (HQ AFSC/PL) introduced the questionnaire. In a final attempt to increase the response rate, I sent a follow-up letter (appendix C) to the program directors and quality assurance personnel. This letter signifi-

cantly increased the response rate of the program directors and the quality assurance personnel. A follow-up letter was not sent to the program managers because of the large numbers and cost involved.

Development and Validation of Survey Instrument

As stated previously, poor questionnaire design can result in unacceptable response rates that can invalidate the research effort. I originally included more than 150 questions in this survey effort. These questions were submitted to and reviewed by personnel at AFSC's Aeronautical Systems Division, Directorate of Engineering (ASD/EN), Directorate of Contracting and Manufacturing (ASD/PMD), and Human Resources Laboratory (ASD/HRL). I also sought assistance from the Air Force Institute of Technology (AFIT) and Headquarters AFSC, Deputy Chief of Staff, Product Assurance (HQ AFSC/PLEQ). Next I prepared a draft questionnaire of 66 questions, which incorporated the inputs from these reviews. I then sent a revised questionnaire to these same organizations for review. After incorporating several added changes, I provided a copy to the Air University, Deputy Chief of Staff, Operations and Plans (AU/XPZ), for review. Personnel in this office assisted in developing the five-point, Likert-type scale used for the majority of the questions. Finally, I developed another draft questionnaire with 74 questions, incorporating AU/XPZ's recommendations for the program directors and managers.

I selected four students attending Air Command and Staff College, Maxwell AFB, Alabama, who had previous program management experience, to pretest the questionnaire. They were asked not only to complete the questionnaire but to evaluate the questionnaire's structure:

- How long did it take to answer the questionnaire?
- Are the questions clear and without assumptions?
- Are there any terms that could be misinterpreted?
- Are any questions biased?
- Are the instructions clear?

All four ACSC students returned the questionnaires and provided comments that were incorporated into the final draft.

I modified the first section of the program director and manager questionnaire to get additional information about the background and educational experience of the quality assurance personnel. This additional background information is the primary difference between the two questionnaires developed for this research project. Both questionnaires were sent to the Air Force Manpower and Personnel Center, Personnel Survey Branch (HQ AFMPC/DPMYOS) through AU/XPZ for approval to survey Air Force civilian and military personnel. They requested only editorial and typographical changes. Formal approval was received from Headquarters AFMPC/DPMYOS by a letter dated 2 December 1987.

Description of Survey Instrument

The program director and project manager's questionnaire is included as appendix D and the questionnaire for quality assurance personnel as appendix E. As stated in the previous section the primary difference between the two questionnaires is in the work force profile, which provides general background information. Question 25 on the quality personnel questionnaire corresponds to question 12 on the program director questionnaire. The reason for using identical questions was to compare the responses from each subpopulation.

Both questionnaires contain six sections or groups of questions. The first section requests background information on rank, experience, education, and training. This information is used to categorize the three survey groups and compare how the quality assurance work force has changed. The next section (questions 13–21 on the program director survey) deals with the cost-of-quality concept and asks respondents to identify costs for each component of quality (i.e., failures, inspection, and prevention). The purpose of those questions is to determine if people understand and receive cost-of-quality data and if they use it to manage their programs. The third group of questions (12, 22–50) identifies those items that can improve or impair quality. This group of questions seeks to determine how prevalent those practices are in Air Force quality assurance programs. The fourth section (questions 51–60) identifies indicators of quality that should be analyzed by government and contractor personnel to control the cost of quality. The fifth group of questions (61–70) identifies specific approaches that government and contractor personnel can use to achieve better quality. The last section (questions 153–158) asks respondents to rank the top three contributors to and detractors from achieving high quality and productivity.

Selection of Statistical Tests

The Statistical Package for Social Sciences-X (SPSS-X) was used for the analysis of the survey data. Since most of the questions used a nominal Likert-type scale, nonparametric statistical tests were used to analyze the data. However, some parametric tests, such as the *t* test and analysis of variance (ANOVA) test, were used because of the additional information provided by these tests, but only in conjunction with appropriate nonparametric tests

One of the simpler techniques used to analyze the survey data was to review the distribution of responses for each question. Especially important were those items where a significant number of respondents were grouped toward the extreme ends of the scale. For example, question 50 in the program director survey identified that more than 60 percent of those who responded felt that Headquarters AFSC's leadership was contributing very little or not at all to improving the quality of their system. The analysis

technique of combining the two outside categories of a five-point Likert scale is described by John W. Best and James V. Kahn.[5]

The mode, another useful statistical measurement, was used to identify which response was most frequently chosen for each question. The mean or arithmetic average was not used since much of the data was coded on a nominal scale. The frequency distributions of each subpopulation were also compared for agreement among and between subpopulations. Several different statistical tests were used to determine what appeared to be a lack of agreement between subpopulations. These tests are described in the following paragraphs.

The cross tabulations (CROSSTABS) available in SPSS-X was also used to test how the responses from one question might affect another question. For example, would military or civilian rank affect how one answered a question? Question 2 in the quality assurance personnel survey asked for the respondent's military rank. This information was used to compare how military rank affected the response to various questions (e.g., question 43, the benefits of an award-fee contract to improve product quality). This test was very helpful in identifying how certain subsets within subpopulations respond to questions. An important question to ask is whether the three subpopulations agreed on various questions. Another interesting question is whether on average military and civilian QA personnel respond the same way. Many statistical tests are available in SPSS-X to perform these types of analysis.

The Kruskal-Wallis one-way analysis of variance by ranks is one of the most useful and reliable nonparametric tests available to determine if there is agreement among three or more different subpopulations. With more than 360 total responses in this research effort, the likelihood of total agreement is small. But the question is whether there really is a significant difference among the subpopulations or whether the differences are just those expected from a random sample. Compared with the one-way analysis of variance (ANOVA) F test, the Kruskal-Wallis test has a power efficiency of about 96 percent.[6] Although the data does not satisfy the assumptions of parametric statistics, the F test was run to see if the results would be the same. Since the F test is a more powerful test, running the F test would give additional confidence if both tests provided the same results. This test determined how well the program directors, program managers, and quality assurance personnel agreed on various subjects. One would think that the philosophy of the program director would permeate the entire organization and there would tend to be agreement among these subpopulations.

The Mann-Whitney U test was used to test whether two independent groups were from the same population. It was used specifically to see if military and civilian quality assurance personnel were in agreement with how they answer survey questions. (Again, one would hope that quality assurance personnel as a whole would be using similar management philosophies throughout AFSC.) This test is one of the most powerful

nonparametric tests and the best alternative to the *t* test, a parametric statistic for comparing samples from a population. When compared with the powerful *t* test, the Mann-Whitney test has a power efficiency of about 95 percent.[7] As before, the *t* test was run to compare the results with the Mann-Whitney *U* test in order to obtain additional confidence with this test.

Questions 153–155 provided a list of 10 items and asked the respondents to rank the three most important contributors in improving quality. A similar request was made in questions 156–158, which asked the respondents to rank the three most important items that detract from achieving quality. The data from these questions was run on the SPSS-X software program called Multi-Response. This program rank orders the responses by frequencies and percentage of total responses. This output provides a ranking of what people think are the most important contributors and detractors of quality products. The results of these tests are presented in chapter 4 and the conclusions and recommendations drawn from the data are presented in chapter 5.

Notes

1. Floyd J. Fowler, Jr., *Survey Research Methods* (Beverly Hills, Calif.: SAGE Publications, 1984), 66.
2. Ibid., 71.
3. Based on a standard error of proportion where:

   N = population size = 1000
   n = sample size = 200
   z = confidence = ±1.96 for 95 percent
   d = error rate
   p = estimate of actual population (set to 0.5 as a conservative estimate)
   q = (1–p)

   and

$$d = z\sqrt{\frac{pq}{n}\cdot\frac{N-n}{N-1}}$$

   thus for this example, d = 0.062 or error rate ±6 percent.

   For the QA respondents (where N = 185 and n = 94), d = 0.071 or error rate of ±7 percent.

   For the program directors (where N = 145 and n = 61), d = 0.096 or error rate of ±10 percent.

   For the program managers (where N = 1402 and n = 217), d = 0.061 or error rate of ±6 percent.

4. John W. Best and James V. Kahn, *Research in Education* (Englewood Cliffs, N.J.: Prentice-Hall, 1986), 166.
5. Ibid., 181.
6. Sidney Siegel, *Nonparametric Statistics for the Behavioral Sciences* (New York: McGraw-Hill, 1956), 192–93.
7. Ibid., 126.

CHAPTER 4

Findings

In this chapter I summarize the results of investigating the six research questions presented in chapter one. First, I give a demographic analysis of the acquisition work force showing the characteristics of each subpopulation: program directors (PD), program managers (PM), and quality assurance (QA) workers. Then I note important recommendations from previous studies that relate to this research study. In the remainder of the chapter, I show the responses of each subpopulation to a specific research question. I provide the raw data in the following appendixes: program directors in appendix F, program managers in appendix G, QA military personnel in appendix H, and QA civilian personnel in appendix I.

Demographic Data: Program Directors, Program Managers, and Quality Assurance Personnel

The rate of response to the survey questionnaires was good enough to permit valid inferences from the results. Of the 145 program directors queried at the five AFSC product divisions, 61 (42%) returned fully completed surveys. Out of the sample of 640 program managers at these same product divisions, 217 (34%) responded. I queried 185 QA personnel at these product divisions; 94 (51%) returned the questionnaires.

Table 4 shows the frequency distribution by the respondent's rank or grade. Seventy-one percent (71%) of the program directors are colonels or GM-15s. Sixty percent (60%) of the program managers are captains or equivalent or less, which indicates a young, probably inexperienced, program management work force. Eighty percent (80%) of the civilian QA personnel are in the grade of GM-12 or -13 and 74% of the military QA personnel are lieutenants.

TABLE 4

Rank and Grade Frequency Distribution

Category	Absolute Frequency (n)			Relative Frequency (%)		
	PD	PM	QA	PD	PM	QA
Brig Gen, GM-16, or higher	7	3	0	11.5	1.4	0.0
Col or GM-15	43	3	0	70.5	1.4	0.0
Lt Col or GM-14	10	40	5	16.4	18.4	5.3
Maj or GM-13	0	41	26	0.0	18.9	27.7
Capt, GM-12, or lower	1	130	63	1.6	59.9	67.0
TOTAL	61	217	94	100.0	100.0	100.0

Table 5 indicates the years of experience in the program management function. More than 70% of the program directors have 10 or more years of experience in program management. A cross-tabulation analysis on the program director's data indicates that 100% of the brigadier generals, 81% of the colonels, and 67% of the lieutenant colonels or equivalents have eight or more years of program management experience. Only 12% of the program managers have 10 or more years of experience, while 73% have five years or less of experience. A cross tabulation shows that all the brigadier generals, 33% of the colonels, 51% of the lieutenant colonels, 20% of the majors, and 7% of the captains have eight or more years of experience in program management.

TABLE 5

Number of Years in Program Management

Category	Absolute Frequency (n)		Relative Frequency (%)	
	PD	PM	PD	PM
10 years or more	43	26	71.7	12.0
8–9 years	5	17	8.3	7.8
6–7 years	3	17	5.0	7.8
4–5 years	3	42	5.0	19.4
3 or less	6	115	10.0	53.0
TOTAL	60	217	100.0	100.0

Table 6 shows the number of years that QA personnel have worked in quality. Twenty-five percent (25%) of the civilians have worked 18 or more years while 19% have worked in quality no more than three years. Ninety-two percent (92%) of the military QA personnel have no more than three years of quality experience. This finding also indicates a very young and inexperienced work force.

TABLE 6

Number of Years in Quality Assurance

Category	Absolute Frequency (n)		Relative Frequency (%)	
	MIL	CIV	MIL	CIV
18 years or more	0	17	0.0	25.4
13–17 years	0	8	0.0	11.9
8–12 years	0	13	0.0	19.4
4–7 years	2	16	8.0	23.9
3 or less	23	13	92.0	19.4
TOTAL	25	67	100.0	100.0

Table 7 indicates the number of different systems or items that the respondents have worked on. Almost 60% of the program directors, 25%

of the program managers, and 65% of the QA personnel have worked on five or more systems. However, 46% of the program managers and 45% of military QA personnel are working on their first or second system. The cross tabulation shows that among program directors 71% of the brigadier generals, 65% of the colonels, and 30% of the lieutenant colonels or equivalents have managed five or more systems. For program managers, 100% of the brigadier generals, 67% of the colonels, 35% of the lieutenant colonels, 15% of the majors, and 23% of the captains or equivalent have managed five or more systems.

TABLE 7

Number of Systems or Items Managed

Category	Absolute Frequency (n)			Relative Frequency (%)		
	PD	PM	QA	PD	PM	QA
5 or more systems/items	36	54	60	60.0	25.1	64.5
4 systems/items	8	22	5	13.3	10.2	5.4
3 systems/items	8	40	11	13.3	18.6	11.8
2 systems/items	4	50	7	6.7	23.3	7.5
1 system/item	4	49	10	6.7	22.8	10.8
TOTAL	60	215	93	100.0	100.0	100.0

Table 8 indicates the number of years that the respondents have worked on their current program. It shows that more than 70% of the program directors and managers and 56% of the QA personnel have less than two years experience on the current program.

Table 9 indicates the acquisition phases of the system or item for which the respondents are primarily responsible. Ninety-three percent (93%) of the program directors, 84% of the program managers, and 84% of the QA personnel are working on programs in the full-scale development, production, or deployment phases. The cross tabulation for program directors indicates that only two colonels and two lieutenant colonels are working on programs in the conceptual and demonstration-validation phases. A cross tabulation for program managers shows that no colonels and only 20% of the lieutenant colonels, 15% of the majors, and 14% of the captains or equivalents are responsible for programs in the conceptual and demonstration-validation phases. Some respondents indicate that they are responsible for systems in several phases and therefore have difficulty answering specific questions. In this situation, most provide what they think is an average response for all their systems. Some respondents indicate that their programs are in the conceptual or demonstration-validation phases and they feel many questions are not applicable and therefore either left the question blank or did not complete the questionnaire. (These blank answers are not used in the analysis.)

Based upon comments received, I suspect that many of the questionnaires were not returned because of an apparent common misconception that the quality function has little role to play in the early acquisition phases. However, the questionnaire was designed around the total quality management (TQM) philosophy, which should not be constrained by acquisition phases. This lack of response could indicate that a significant number of respondents do not understand the TQM approach.

TABLE 8

Number of Years on Current Program

Category	Absolute Frequency (n)			Relative Frequency (%)		
	PD	PM	QA	PD	PM	QA
5 or more years	5	5	11	8.2	2.3	12.1
4 years	5	13	18	8.2	6.1	19.8
3 years	8	47	11	13.1	22.0	12.1
2 years	13	63	35	21.3	29.4	38.5
1 year	30	86	16	49.2	40.2	17.6
TOTAL	61	214	91	100.0	100.0	100.1

TABLE 9

Acquisition Phase

Category	Absolute Frequency (n)			Relative Frequency (%)		
	PD	PM	QA	PD	PM	QA
Conceptual	2	6	3	3.3	2.8	3.4
Demonstration-Validation	2	27	11	3.3	12.7	12.5
Full-scale Production	28	100	40	45.9	47.2	45.5
Production	25	48	30	41.0	22.6	34.1
Deployment	4	31	4	6.6	14.6	4.5
TOTAL	61	212	88	100.0	99.9	100.0

Table 10 indicates how many full-time quality assurance personnel are assigned to the organization. Approximately 33% of the program directors, 31% of the program managers, and 39% of the QA personnel report that they have four or more full-time QA personnel assigned. A significant number of the program directors (16%) and program managers (26%) say they have no full-time QA assigned. These individuals are totally responsible for all aspects of quality on these programs, yet they have had very little education or training in quality (table 11).

TABLE 10

Full-time Quality Assurance Personnel Assigned

Category	Absolute Frequency (n)			Relative Frequency (%)		
	PD	PM	QA	PD	PM	QA
4 or more assigned	20	64	35	32.7	30.7	38.9
3 assigned	3	16	17	4.8	7.7	18.9
2 assigned	10	26	13	16.8	12.4	14.4
1 assigned	18	49	16	29.4	23.4	17.8
0 assigned	10	54	9	16.3	25.8	10.0
TOTAL	61	209	90	100.0	100.0	100.0

Almost half (43%) of the program directors and more than half (64%) of the program managers have had little training and education in quality (table 11). The cross tabulation for program directors indicates that 50% of the brigadier generals and 47% of the colonels or equivalent have had nine hours or less of training in quality improvement. For the program managers 100% of the brigadier generals, 67% of the colonels, 43% of the lieutenant colonels, 55% of the majors, and 73% of the captains or equivalents have had nine hours or less of such training. Yet, 23% of the program directors and 32% of the program managers spend more than two hours a day (20% or more of their time) on quality issues such as failures or corrections (table 12).

TABLE 11

Training or Education on How to Improve Quality

Category	Absolute Frequency (n)		Relative Frequency (%)	
	PD	PM	PD	PM
40 or more hours	9	23	15.0	10.7
39–30 hours	3	7	5.0	3.3
29–20 hours	11	18	18.3	8.4
19–10 hours	11	29	18.3	13.5
9 or less hours	26	138	43.3	64.2
TOTAL	60	215	99.9	100.1

Table 12 also reveals that a very large percentage of the program directors (48%) and program managers (34%) are spending at least an hour every day making decisions affecting quality. Since they probably have not had the education or training to help make these decisions, the question to be asked

is: Do they have the right information to make that decision? Answering this question is part of the objective of this research.

TABLE 12

Hours Spent on Quality Issues

Category	Absolute Frequency (n)		Relative Frequency (%)	
	PD	PM	PD	PM
5 or more hours	0	10	0.0	4.8
4–3 hours	4	23	6.7	11.0
2 hours	10	33	16.7	15.7
1 hour	29	71	48.3	33.8
0 hour	17	73	28.3	34.7
TOTAL	60	210	100.0	100.0

When asked about the type and value of quality education and training, 66% of the civilians and 44% of the military of the QA personnel said adequate opportunities are available to attend formal courses. Nevertheless, 46% of the civilians and 85% of the military have had less than five weeks of training. Only 37% of the civilians and 10% of the military say the training has helped a great or very great extent on their job. The survey asks to what extent certain topics have been covered in formal courses and how important they might be on the job. These topics include manufacturing processes, cost-of-quality concepts, testing procedures, contract requirements, and statistical process control (SPC). Thirty-seven percent (37%) of the civilians and 70% of the military say they have had no SPC courses in the last five years. Approximately 55% of military and civilians indicate that the listed topics are covered very little or not at all in the courses. Seventy percent (70%) of the civilians and 55% of the military also indicate that these topics would be very valuable in their job.

Summary of Demographic Data

Based on the responses, the "typical" program director is a colonel or GM-15 with more than 10 years of program management experience who has managed over five systems and has been on the current program less than three years. He or she has had a lot of program management training (more than 10 weeks) but little on quality or product performance and durability. His or her system is in the full-scale development or production phase and he or she has one to two quality personnel assigned full time. Only six percent (6%) of the program directors were in the conceptual or demonstration-validation phases, yet 16% report no QA personnel assigned full time. This means at least 10% of AFSC's programs have no QA

personnel assigned full time in the full-scale development (FSD) or production phase.

The "typical" program manager was a captain or GM-12 with less than three years of program management experience. He or she has worked on one or two systems and has been assigned to the current program less than three years. He or she has had six to seven weeks of program management training but little on quality or product performance and durability. His or her system is in the full-scale development or production phase and has one or two full-time QA personnel assigned. As with the program directors, only a few (16%) of the program managers were in the conceptual or demonstration-validation phases, and 26% reported that no QA personnel are assigned full time to these phases of the acquisition process.

A "typical" QA civilian is an engineer in grade of GM-12 or -13 with 10 years of experience. He or she has worked on five systems and been on the current program, which is in the FSD phase, about three years. He or she works with two to three other QA personnel. Training time is available about two-thirds of the time and he or she may have taken one SPC course and one product performance course in the last five years. However, about 40% have had neither of these courses.

A "typical" military QA person is an engineer in the grade of first lieutenant with three or fewer years of experience. He or she has worked on three systems and has been on the current program, which is also in the FSD phase, about two years. He or she either works alone or has three to four QA personnel assigned to the program. The respondents indicate that opportunities for training are available only about half as often as they should be. He or she probably has not received any SPC courses, only one product performance course, and no more than five weeks of QA training.

Given the response rate to the questionnaires, I can say with a relatively high level of confidence that the results accurately reflect the thinking of people in the AFSC acquisition community as to how well they are controlling and reducing the hidden factory costs. The next step is analyzing each of the six main lines of inquiry in greater depth.

How Have Past Studies Addressed Total Quality Management?

One purpose of this research is to see to what extent past Air Force studies have addressed ideas of total quality management (TQM). A second objective is to determine from the responses to the survey questions whether the findings of these previous studies are still relevant today. Five of the six previous studies reviewed identify the need to use more positive incentives to motivate contractors to improve quality.

The respondents in the present research are asked to rank positive incentives as to their importance to improving quality. The respondents select this item as the sixth most important contributor to improving quality. Seven survey questions ask which method works best to influence

the contractor to provide better quality. These options included using award fees, warranties, firm-fixed-price contracts, top management involvement, contract requirements, employee motivation techniques, and good business practices. Most respondents indicate that firm-fixed-price contracts do very little to motivate contractors to provide better quality. Warranties and award fees are the two methods the respondents select as having the greatest influence on the contractor. The program directors are consistently more optimistic than the program managers and QA personnel on the effectiveness of these incentives as motivators. One program director says that "DOD . . . under emphasized [the potential of using] positive incentives to [get] the job [done] right the first time."

The need for more QA personnel and for more formal training programs is also identified in three of these studies. Approximately 50% of the respondents in the current research study indicate that the system program offices (SPO) do not have enough QA personnel assigned. The following are a few examples of many written comments provided by the respondents.

A program director said, "Large shortage of experienced quality people."

A program manager said, "require SUFFICIENT, EXPERIENCED, COMMITTED, PEOPLE."

A program director said, "I'm hiring a non-personal service contractor, to support SPO QA people."

Moreover, almost half of the QA work force say that adequate opportunities to attend formal courses were not available. They also indicate that the value of the courses they are able to attend is questionable. The respondents state that these courses included little material on statistical process control, cost-of-quality concepts, and other topics that would be very valuable in performing their jobs. The following are a few written comments provided by the respondents.

A program manager said, "AFSC training is a shambles not meeting the needs of new managers . . . ignoring the need to train quality managers up front just like maintenance officers."

A QA manager said, "QA personnel for the Government should be forced to attend QA classes."

A program manager said, "need more QA classes at AFIT. . . . We need quality people and education."

A third recommendation that all six of the past studies make is the need to obtain cost-of-quality data and use it to measure contractor performance. Research questions five and six specifically address to what degree the SPO and contractor are using this information. The findings of the current study indicate that approximately half of the work force are still not reviewing or using this data even though it is required by many government regulations. As shown by the following comments, the respondents fail to understand the value of this data, how to use it, and even what data to obtain.

A program manager said, "No hardware yet to measure its quality."

A program director said, "Just started [fabrication] of test article," therefore, no scrap, rework, repair, or cost of quality data.

A business manager (27xx) said, "responsible for analysis of contractor total program cost and schedule variance data . . . not close enough to quality speciality to really have much insight on how it operates."

A program manager said, "Quality needs to be *measurable throughout* the weapon system acquisition process."

A program director said, "I do not know how to quantify these costs. . . . Spacecraft program . . . long life without repair."

A program manager on a software program said, "hardware items, scrap, etc., are not applicable."

As many of these comments indicate, several respondents think of quality as an inspection function to be done by quality assurance personnel on hardware in the production phase. According to TQM, this perception must be changed if the hidden factory costs are going to be reduced.

Four of the studies see the need for top management to commit itself to accepting quality products. Most of the respondents rate the commitment to not accepting poor quality as the second most important contributor to quality. Other survey data from the current study indicates that quality is a very important objective in the SPO but is not receiving the resources commensurate with this ranking. The respondents also say that the staff QA personnel and Headquarters AFSC leadership are doing very little to improve quality. The following comments seem typical of what the work force thinks of top management's commitment to quality.

A program manager said, "senior leadership displays a lack of integrity in excuses given for failure and poor planning/decisions on their part."

A program manager said, "Problem is the lack of ability to make a decision by upper level personnel . . . they are afraid that it (higher quality) can't be done."

A program manager said, "If the MAJCOM and Air Staff were *really* serious, they would provide the required resources."

A QA manager said, "DOD and AFSC does little to provide the resources and organizational structure for QA."

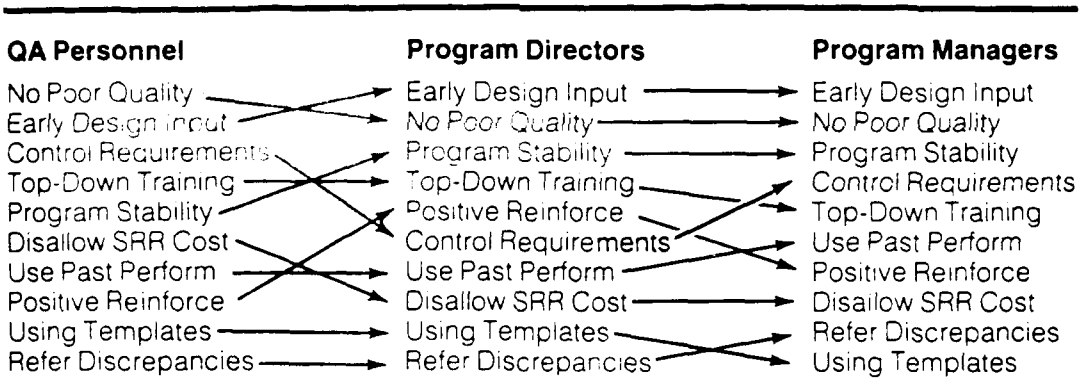
Two of the past studies stress that the importance of quality assurance must be increased to be equal with cost, schedule, and performance. Respondents in this study rank, the low priority the Air Force gives to program objectives as the fourth most important detractor to quality out of the 10 listed in the questionnaire. Most program directors and managers indicate that schedules have affected quality to a very little extent. However, only about 20% of the QA personnel agree. A QA manager with 30 years of experience comments that "major programs [are] giving lip-service to quality." Additionally, the data indicates that the value or effectiveness of the QA personnel is not highly rated. This finding may result because of too little manpower, lack of training, or some other factors. However, visibility does not appear to be a problem to the program director but could

be with program managers. A program manager comments that "quality personnel seem to be very unaggressive or . . . unaware of their role."

What Are the Most Important Factors Affecting Quality?

A second purpose of this research is to determine what the acquisition work force thinks are the most important contributors in improving quality and productivity by asking the respondents to rank the top three factors from a list of 10 items that affect quality. These items are then compared to the responses of over 20 survey questions to assess what the acquisition personnel are actually doing. The three subpopulations show strong agreement in how they rank many of the factors that contribute to better quality (table 13). The top three are early inputs into the design process (producibility, manufacturing, and quality); commitment to not accepting poor quality; and program stability (including funding, requirements, and the design).

TABLE 13
Contributors to Better Quality



Two questions directly relate to what the respondents chose as the most important contributor to quality. The first question asks respondents to what extent they are using a development process that designs quality into the product. Approximately 60% of the program directors, 30% of the program managers, and 30% of the QA personnel say they are using this process a great to very great (Great-V.G.) extent (fig. 1). However, 25% of the QA and 35% of the program managers either do not answer (because they do not know) or say that they were not using this process at all or were using it very little (Not Answ-V.L.). The important indicators or trends with respect to a TQM philosophy should lie at the extremes of the scale. For example, if 30% answer they are using this process a lot (Great-V.G.) and 30% say to some degree (Some), then one could surmise that 60% are using this process at least to some degree and could conclude that this response

rate is good. However, does 60% using this process some represent a true commitment to TQM? One could reasonably argue that to achieve a high level of quality and commitment to TQM 70–80% of the responses must be in the great to very great category.

Figure 2 shows to what extent respondents believe producibility risk reduction efforts are well funded before production. Funding of such quality assurance items is important to ensuring that quality is incorporated early in the design process. Forty to fifty percent (40–50%) of respondents indicate that producibility efforts are not adequately funded to reduce risk and assure quality. Designing quality into the product is no doubt one of the most important elements in achieving a quality product. The respondents recognize that up-front funding of producibility efforts can increase quality, but they also indicate this funding is not happening.

Another important contributor to improving quality and productivity is a commitment to not accepting poor quality. Four of the survey questions measure this attitude. One question asks respondents whether producing a quality product for the user is the organization's most important organizational objective. Program directors feel that quality is a very important objective, but only about 50% of the program managers and 40% of the QA personnel respond positively (fig. 3).

A second indicator of the importance of quality is how much of its resources an organization is expending to improve quality. About 40% of the program managers and QA personnel respond that their agency spends too few of its resources on improving quality (fig. 4). Approximately 40% of the program directors say that sufficient resources are being expended, which does not correlate with their statement that quality is the most important objective. If that is the most important objective, resources can and will be found.

Two survey questions provide an indication of how well the work force is monitoring data that identifies poor quality. Figure 5 shows the results of asking to what extent contractors use material review board, quality deficiency report (MRB/QDR) actions as a measure or indicator of quality. Only 30% of the program managers and QA personnel respond that the contractor is using this information to a significant extent. An even more alarming statistic is that 20% of the program directors and QA personnel and 35% of the program managers do not answer this question (because they do not know). In response to a question about the extent to which they monitor defects and workmanship data, about 50% of the program directors and QA personnel say that they were doing this a lot but only 30% of the program managers agreed (fig. 6). By ranking this item as the second most important contributor to improving quality, the work force shows that it knows the importance of having a commitment to quality. However, the data shows that this commitment is more rhetoric than practice.

The respondents rank top-down corporate training to cultivate awareness of QA's impact on life-cycle costs as the fifth most important contributor improving quality. Two questions measure this belief. One question asks

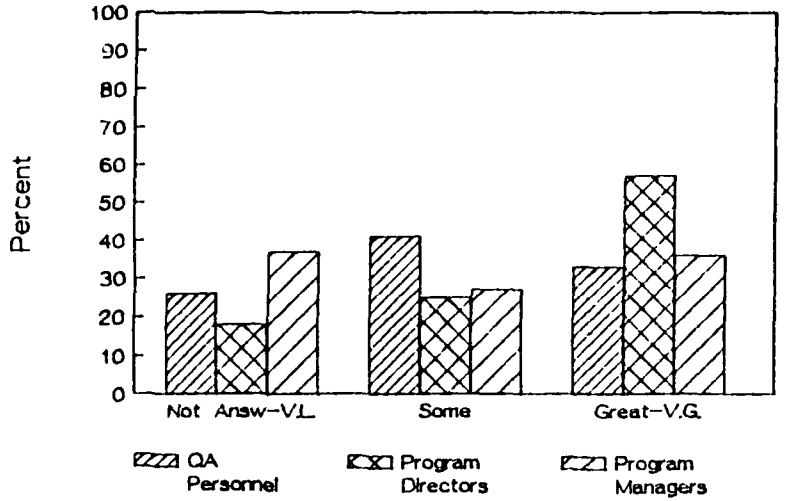


Figure 1. *Development Process* that Designs Quality into the Product.

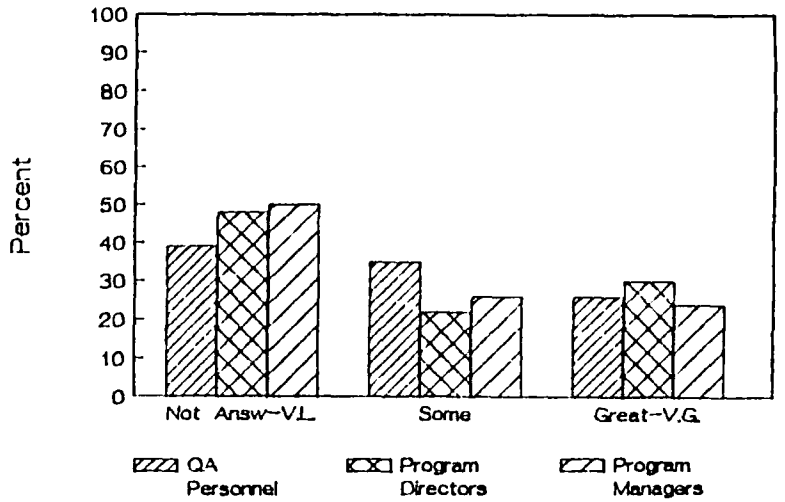


Figure 2. Producibility Risk Funding.

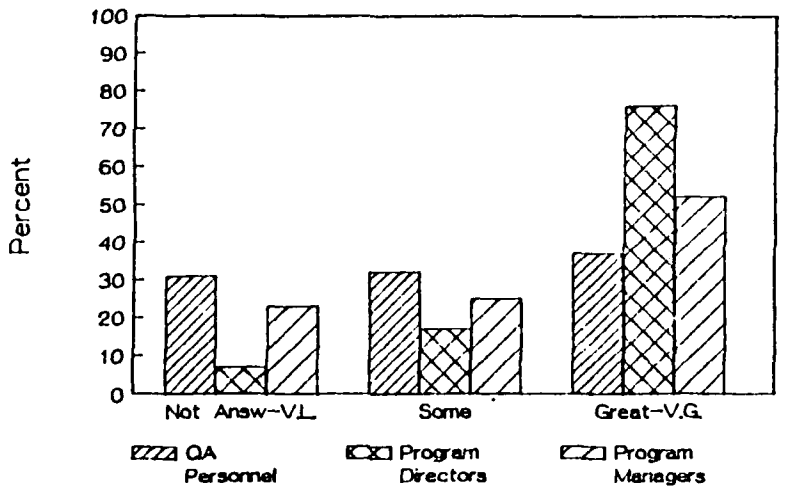


Figure 3. Quality—MOST Important Objective.

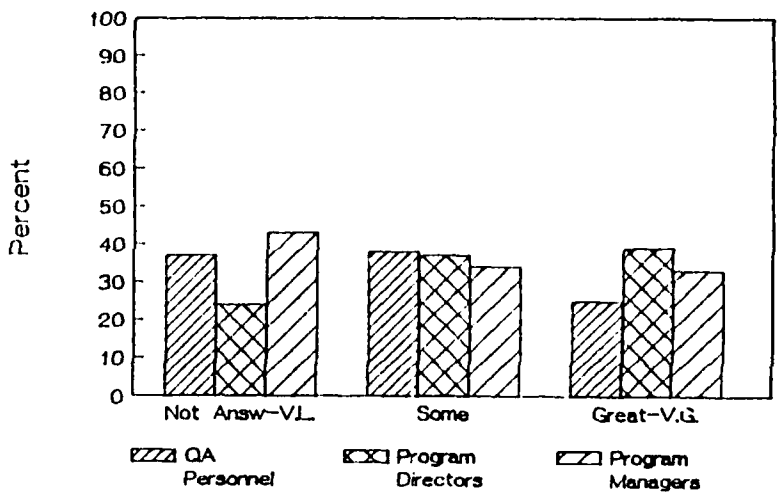


Figure 4. Expending Sufficient Resources.

to what extent SPOs have educational programs aimed at excellence in management and technical fields. Almost 50% of the respondent indicate that the SPO is doing very little in this area (fig. 7). A second question asks to what extent contractor's top management puts emphasis on the quality of the product. Only 30% of the program managers and QA personnel indicate that management is doing a lot in this area (fig. 8). The program director's response also identifies the significant disagreement between them and the program managers and QA personnel. The ranking of this item indicates that respondents recognize the importance of top management training and involvement in achieving a quality product. However, the SPO's top management does not seem to be committed to training, and the contractor's top management does not appear to make a significant commitment to influencing quality.

The respondents rank positive reinforcement programs (incentives) as the sixth most important contributor in improving quality. One question asks to what extent would an award-fee contract influence a contractor to provide a quality product. Only 35% of the program managers and QA personnel believe award-fee contracts would do a lot to get better quality; yet more than 50% of the program directors believe that this incentive would work with their contractor (fig. 9). A second question asks to what extent would a firm-fixed-price (FFP) contract influence contractors to provide a quality product. More than 50% of the respondents said that an FFP contract would do very little to achieve better quality (fig. 10).

The program directors are significantly more positive than program managers and QA personnel in believing that positive reinforcement or incentives are effective motivators. However, most respondents indicate that an FFP contract does not motivate a contractor to provide better quality.

The respondents rank the disallowing of scrap, rework, and repair costs low as an incentive for better quality. Two survey questions reveal why they put this item so low. When asked how often they personally review a contractor's rework, repair, retest, and scrap levels, more than 50% of the program managers and 20% of the QA personnel and about 20% of the program directors say they never review this data (fig. 11). The next question asks how often do they personally review a contractor's "cost of quality" (failure costs + routine inspection + prevention costs) data and trends. More than 40% of the program directors and QA personnel and 60% of the program managers never review this data (fig. 12).

As a second step in determining what factors affect quality, the respondents rank the top three items from a list of 10 that detract from achieving quality and productivity (table 14). The top three are unrealistic program schedules, lack of cooperation among personnel (design, quality, test, manufacturing, etc.), and program instability.

A related question in the survey asks the respondents to what extent have delivery schedules taken priority over quality decisions. Approximately 50% of the program directors and managers say that schedules have had little effect on quality, but only 20% of the QA personnel agree (fig. 13). The

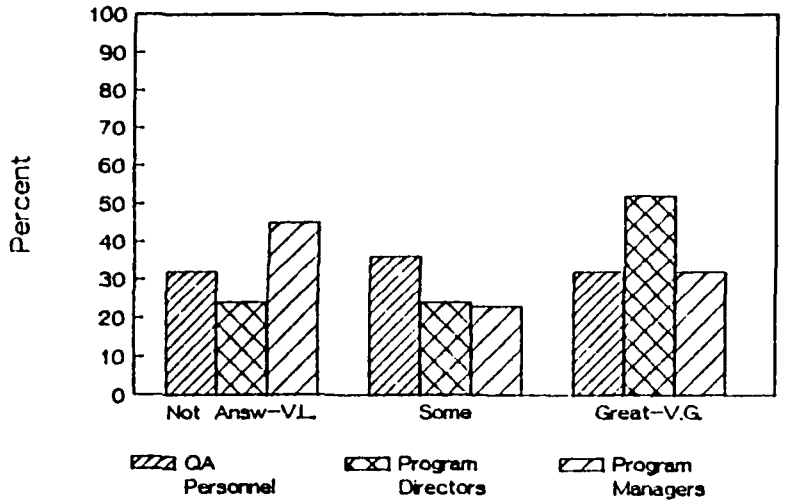


Figure 5. Using Material Review Board/Quality Deficiency Reports.

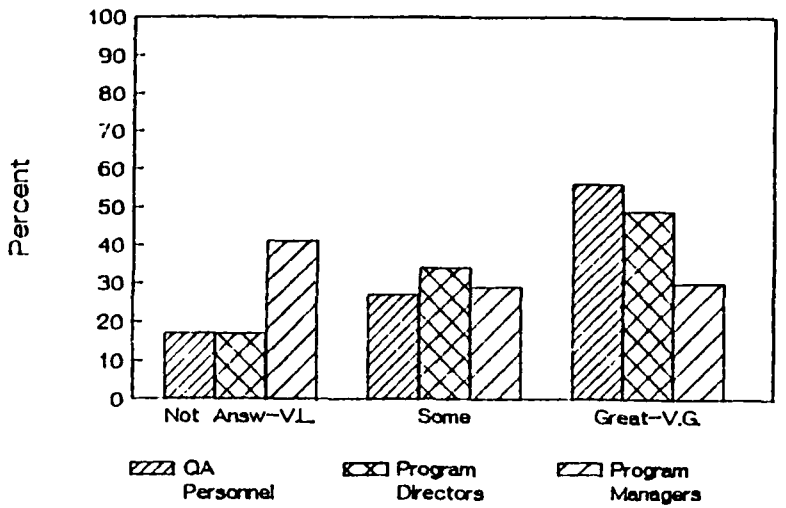


Figure 6. Monitoring Defects and Workmanship Data.

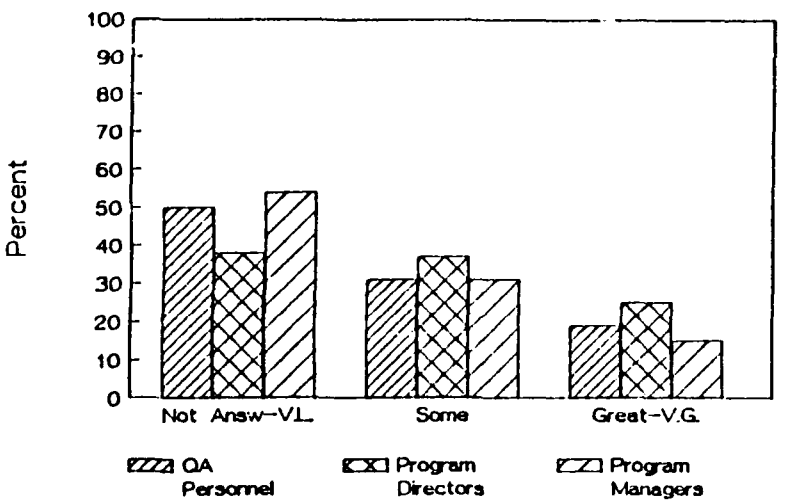


Figure 7. Education Programs Aimed at Excellence in Management and Technical Fields.

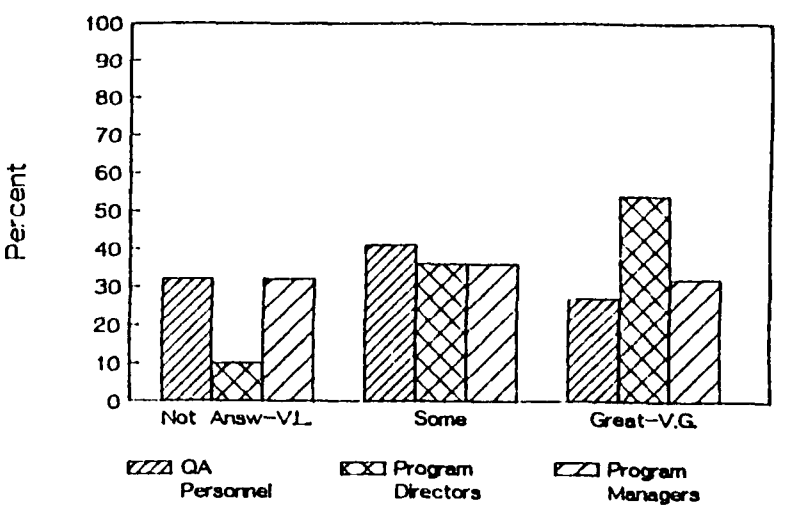
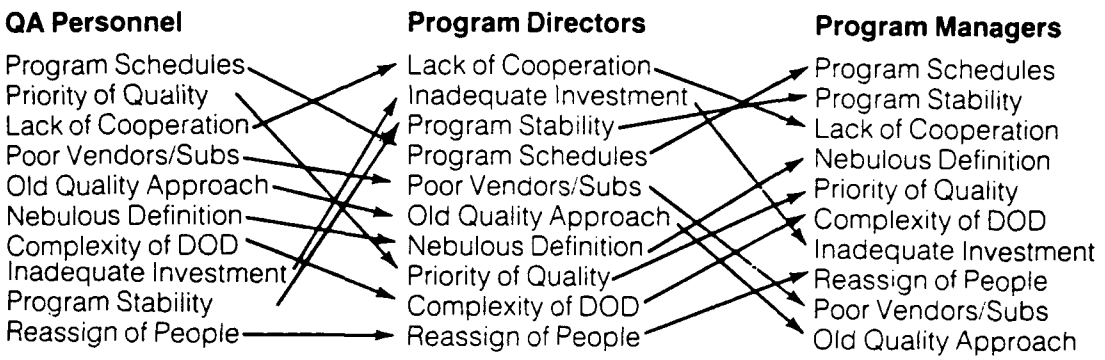


Figure 8. Top Management Influencing the Quality of Your Products.

program managers ranked this item as the number one detractor of quality and program directors ranked it number four, while 40% of the QA personnel indicated that schedules have greatly affected quality (table 14).

TABLE 14
Detractors from Better Quality



Lack of cooperation among personnel is the second greatest detractor of quality, and two survey questions ask what the respondents are actually doing to reduce this problem. Approximately 60% of the program directors, but only 30% of program managers and QA personnel, say they devote a lot of time to attempting to blend the SPO, contract administration service (CAS), and contractor into a team (fig. 14). This question again indicates a significant difference in opinion among the program directors, the program managers, and QA personnel. A second question asks respondents to what extent contractors use design teams to improve quality. Approximately 45% of the program managers and QA personnel indicate that they are accomplishing very little in this area (fig. 15). Twenty-five percent (25%) of the program managers and 10% of the program directors and QA personnel do not answer this question (or do not know the answer). The responses to these two questions indicate that perhaps the communication flow in the program office is not what it should be. The functional areas, the SPO, the CAS, and the contractor historically experience some level of conflict.[1]

The priority of quality within Air Force program objectives ranks fourth as a detractor. Some acquisition personnel say quality is very important, but most do not think their organization is devoting enough of its resources to improving quality. Almost 50% of the respondents indicate that too few people are assigned to the QA function (fig. 16). As past studies reveal, the priority of quality has been a concern for many years and is still a concern among QA personnel.

Program managers and quality assurance workers rank inadequate investment as the sixth most important item, but the program directors chose this item as the second greatest detractor from quality. The

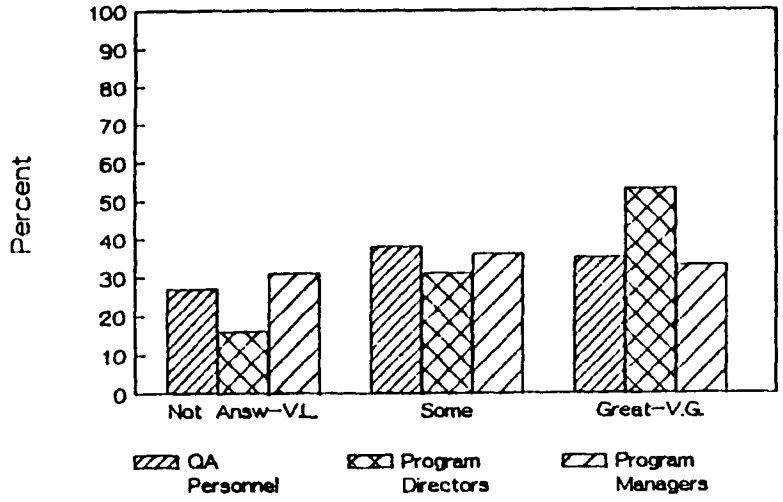


Figure 9. Award-Fee Contract Influence Quality for Your Products.

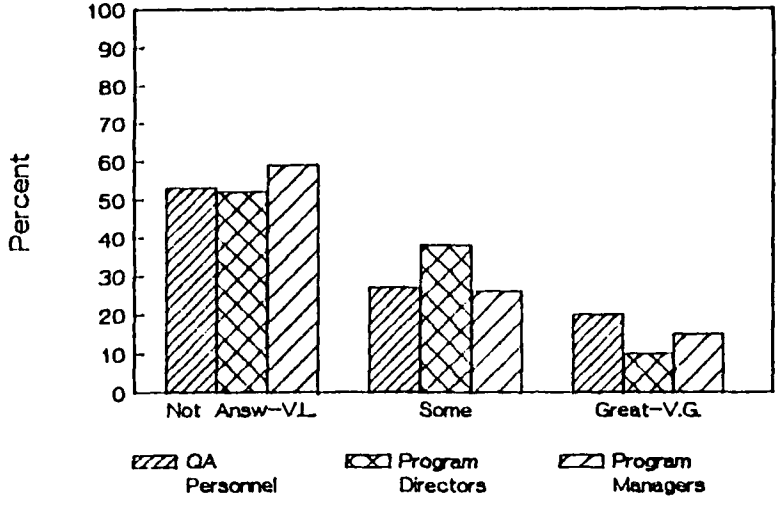


Figure 10. Firm-Fixed-Price Contract Influence Quality of Your Products.

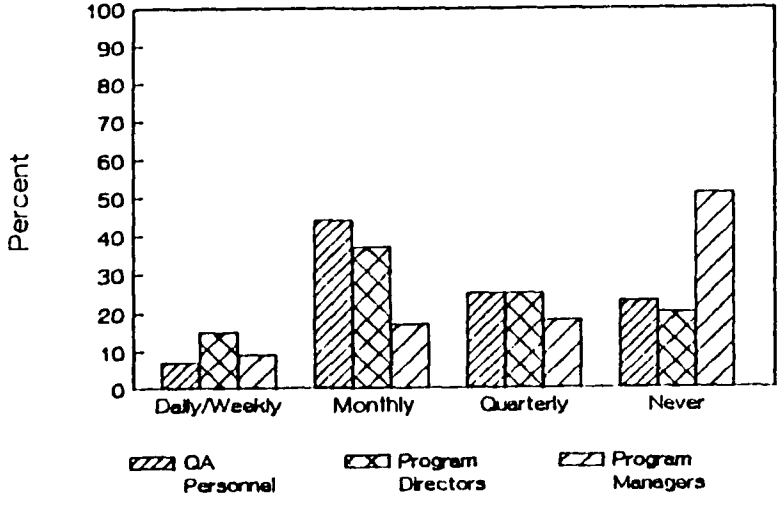


Figure 11. Frequency of Reviewing Scrap, Rework, and Repair Data.

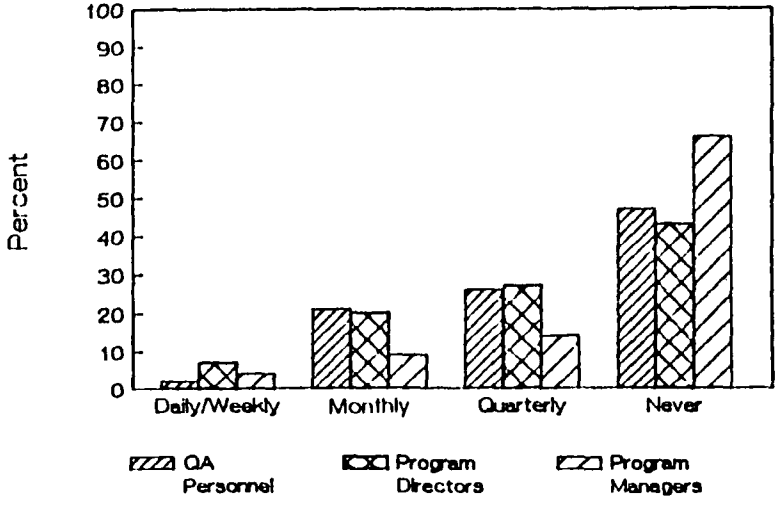


Figure 12. Frequency of Reviewing Cost of Quality Data.

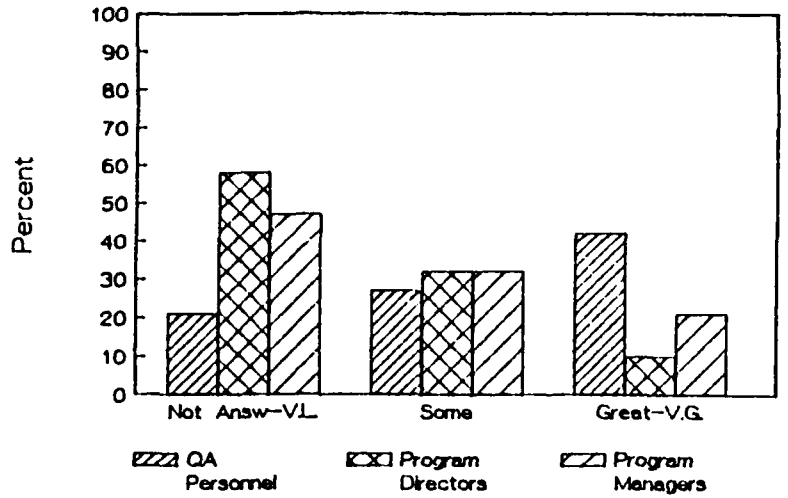


Figure 13. Delivery Schedules Affected Quality of Your Product.

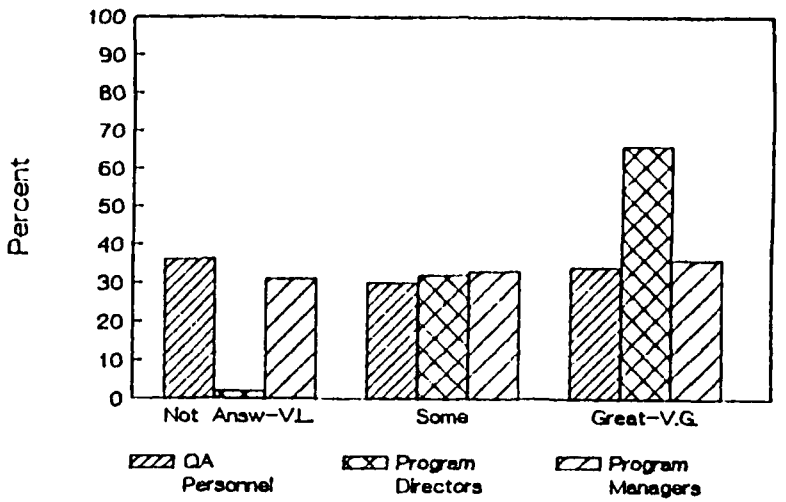


Figure 14. Team Building between the SPO, CAS, and Contractor.

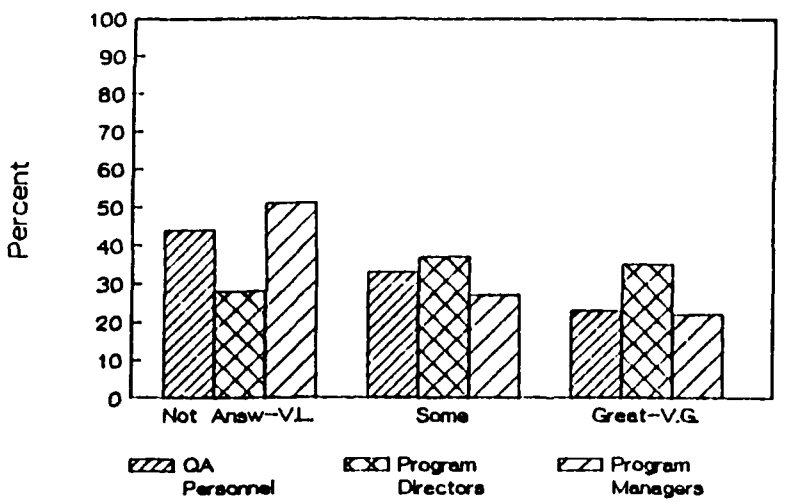


Figure 15. Quality Improvement Process via Design Teams.

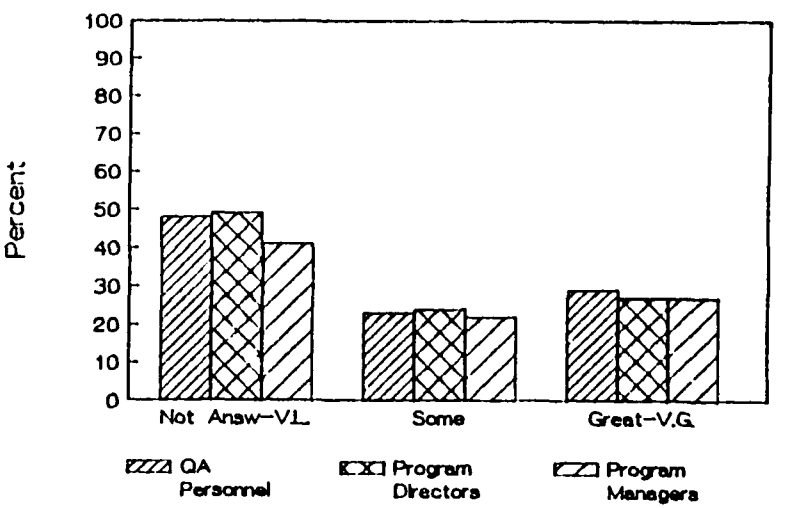


Figure 16. The Right Number of QA Personnel Assigned to the SPO.

responses to the survey indicate that quality is not receiving the up-front support required to address this issue (figs. 2 and 16).

Program managers rank poor vendor and subcontractor quality levels as the seventh most significant detractor, while QA personnel and program directors rank this item fourth and fifth respectively. Fifty-five percent (55%) of the program managers and 45% of the QA personnel responded that the contractor was doing very little to develop active subcontractor quality improvement programs. About 15% of program directors and QA personnel and 30% of the program managers do not answer this question or do not know (fig. 17). Regarding the extent to which the respondents use subcontractor yield rates, 50% of the program directors and QA personnel and 65% of the program managers indicate very little, if at all (fig. 18). A significant number—25% of the QA personnel, 15% of the program directors, and 20% of the program managers—say they do not use subcontractor yield data at all. Only 30% of the program directors and QA personnel say that the contractor is using a preferred vendor program with ratings on quality and schedule to a great extent (fig. 19). Again, 10% of the QA personnel, 20% of the program directors, and 30% of the program managers fail to answer. A final question in this area asks to what extent does your contractor emphasize the supplier's quality. The responses show little agreement among the program director, program manager, and QA personnel (fig. 20). Approximately 50% of the program directors, 25% of the program managers, and 30% of the QA personnel say that the contractor emphasizes supplier's quality a lot. Again, 15% of the program directors and QA personnel and 25% of the program managers fail to answer this question.

One research question asks individuals in the acquisition work force to rank a list of 10 items that can improve quality and a similar list of items that can detract from quality. These items are then compared with other survey questions to determine if they are accomplishing those tasks which affect quality and productivity the most. Most in the population indicate that they are not utilizing concepts that can increase quality and productivity to a great extent. The data also indicates that many respondents cannot or do not answer many questions relating to how quality and productivity can be improved and that the three subpopulations disagree significantly on many questions. This finding indicates a lack of communication within the SPO.

What Is the SPO Doing to Affect Quality?

A third purpose of this research is to measure at what level the acquisition work force is performing certain tasks that increase the level of quality. This research analyzes four aspects of this question: (1) effectiveness of the QA organization in the SPO, (2) effectiveness of motivational techniques to improve quality, (3) impact of quality problems on program management,

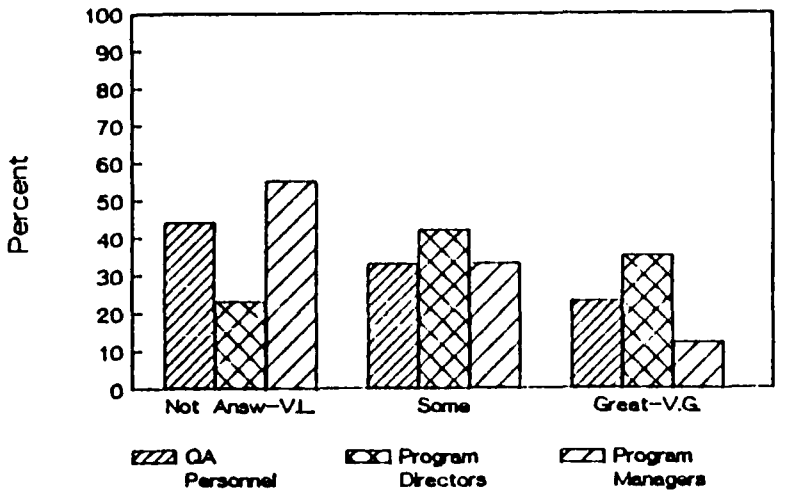


Figure 17. Active Subcontractor Quality Improvement Process.

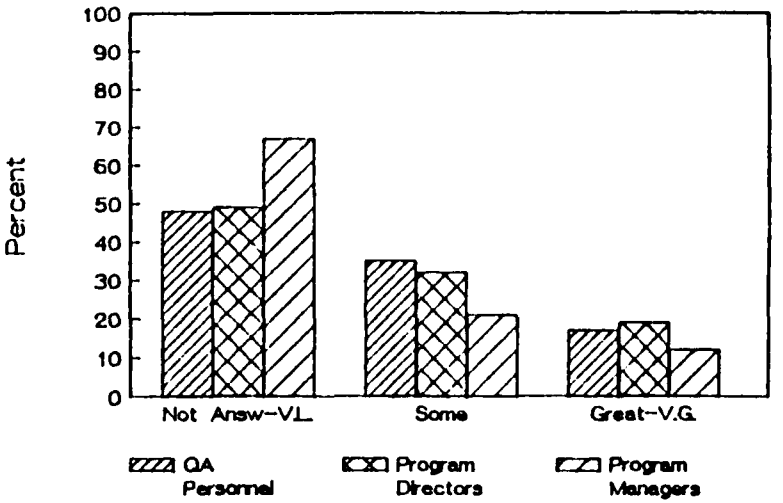


Figure 18. Subcontractor Yield Rates.

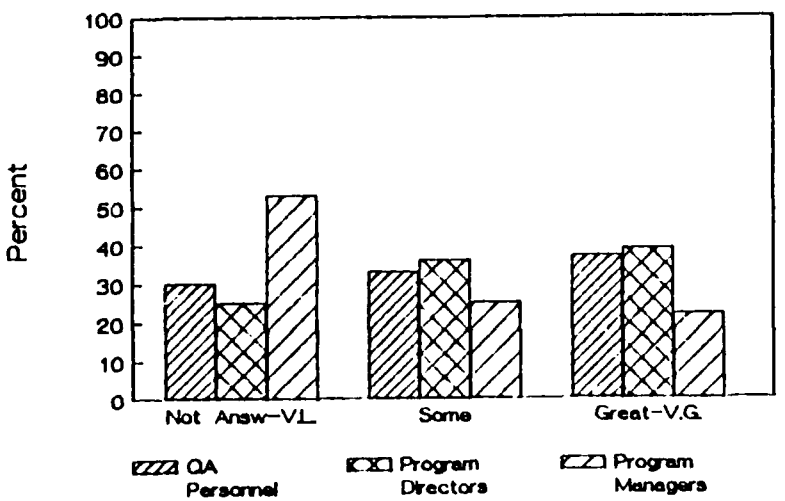


Figure 19. Contractor Using a Preferred Vendor Program for Quality and Schedule.

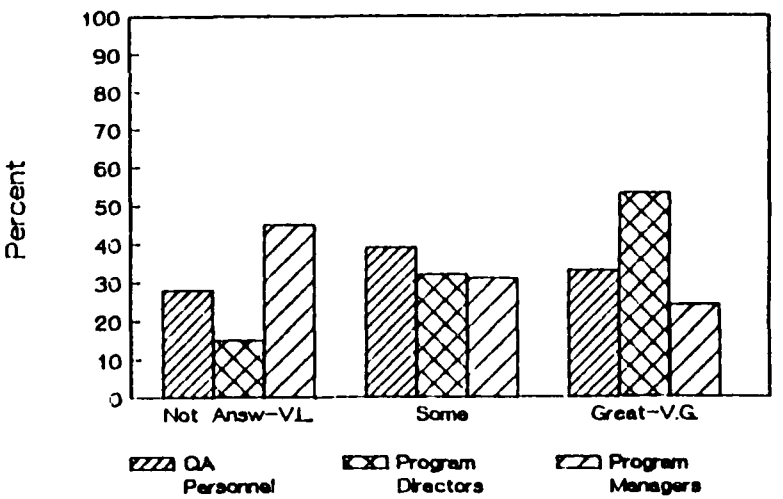


Figure 20. Contractor Emphasis on Supplier's Quality.

and (4) utilization of the quality improvement process. The survey questionnaire includes 30 questions relating to this research objective.

Effectiveness of Quality Assurance in the SPO

Between 40% and 50% of the respondents say that QA personnel contribute only to some extent in achieving a quality product (fig. 21). This outcome is not a strong endorsement of the QA personnel, though the program directors were significantly more positive than the program managers. The program directors indicate an extremely positive communication channel between the program directors and QA personnel, but only 50% of the program managers give this response (fig. 22). This result indicates that although channels are open communication may not be taking place. The responses to other survey questions indicate that each subpopulation has a different knowledge level or perspective concerning many quality issues.

About 30–40% of the respondents are very positive about the kind of QA personnel in their organization (fig. 23). However, 30% of the QA personnel and 40% of the program managers indicate they do not have the right kind of QA personnel working on their programs. About 20% of the program managers do not answer this question. More than 40% of the respondents think that they do not have the right number of QA personnel assigned (fig. 16). This is understandable when 16% of the program directors and 26% of the program managers say they have no full-time QA personnel assigned.

Forty to sixty percent (40–60%) of the respondents say that the QA staff provides little help in getting a better product (fig. 24). Approximately 75% of the respondents think that Headquarters AFSC is doing little to help achieve a quality product (fig. 25). Many respondents feel the QA organization is only somewhat effective in helping to achieve a quality product—probably because of the lack of manpower, but lack of skills may also be a contributor. The data also strongly indicates that Headquarters AFSC and the staff QA organizations need to reassess what they are doing for the SPOs.

Contract Incentives and Improved Quality

Approximately 65% of the program directors and 45% of the program managers and QA personnel say that contract requirements are an excellent way to influence the contractor to improve quality. However, 50% of the QA personnel also say that the contractor can be influenced only to some extent using contract requirements as a motivating technique (fig. 26). Fifty-five percent (55%) of the program directors, 40% of the program managers, and 25% of the QA personnel indicate that the contractor can be influenced a great deal by good business practices (fig. 27)—again, not a lot of agreement among the respondents.

Approximately 30% of the respondents indicate that the user has very little influence on the quality of hardware and services acquired (fig. 28).

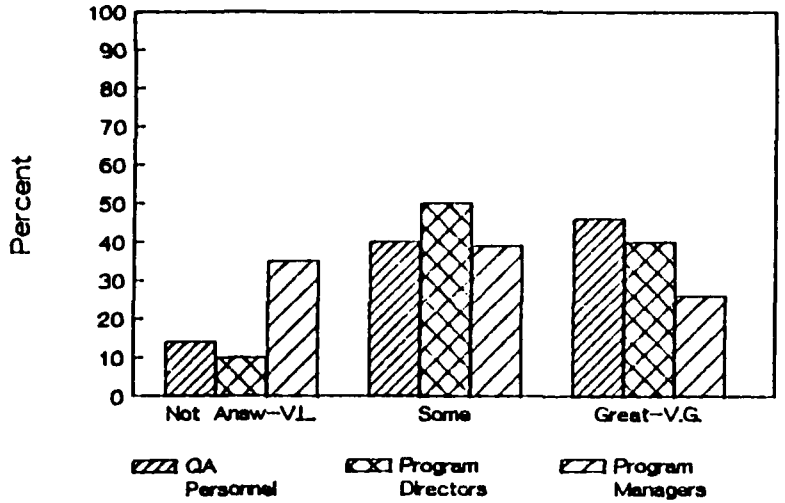


Figure 21. QA Personnel's Help in Achieving Expected Level of Quality.

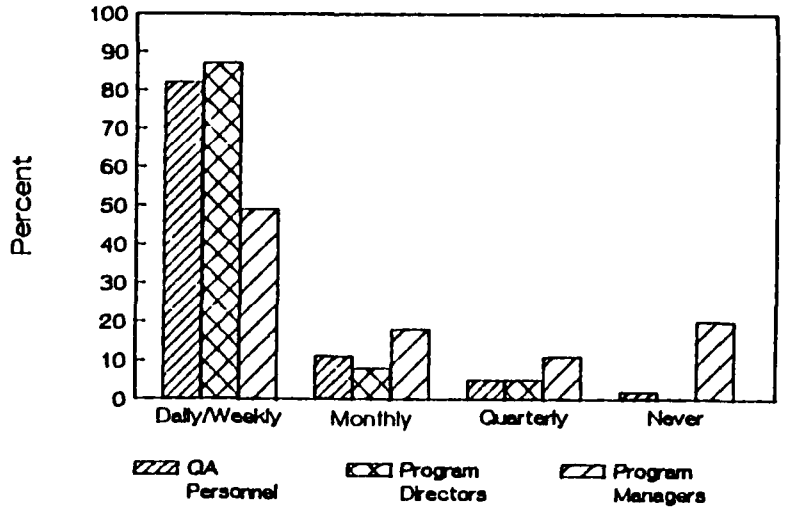


Figure 22. Interface between Quality and Program Management Personnel.

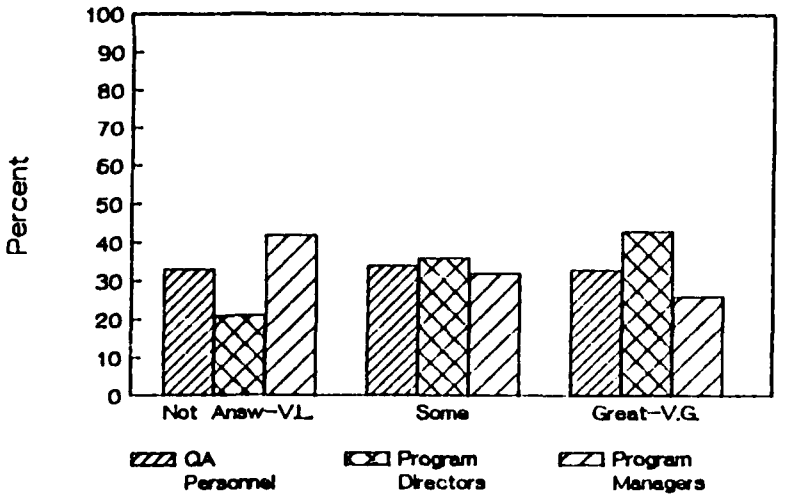


Figure 23. Right Kind of QA Personnel Assigned to the SPO.

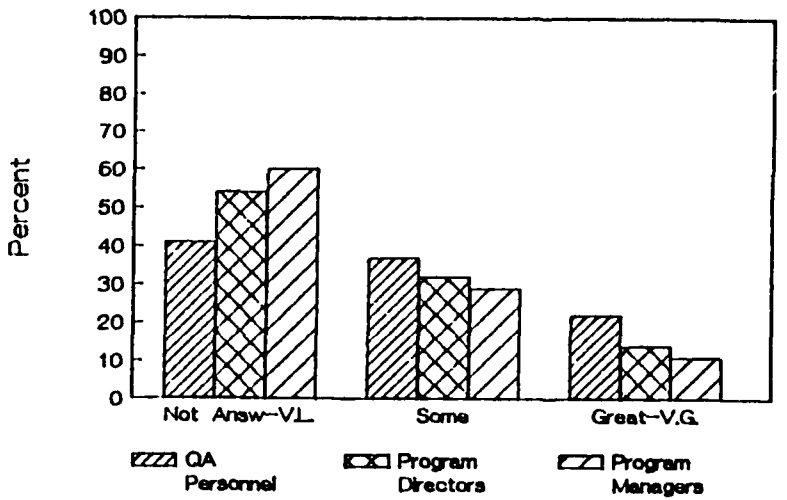


Figure 24. Staff QA Organization Helps Achieve a Quality Product.

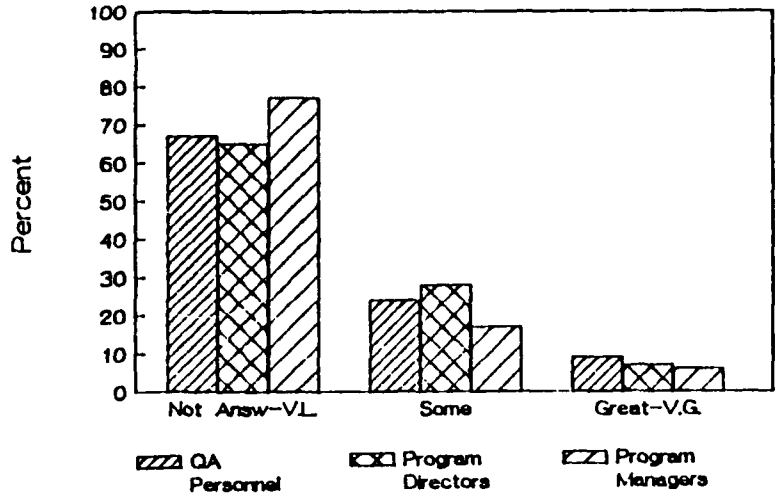


Figure 25. Headquarters AFSC Leadership Helps Achieve a Quality Product.

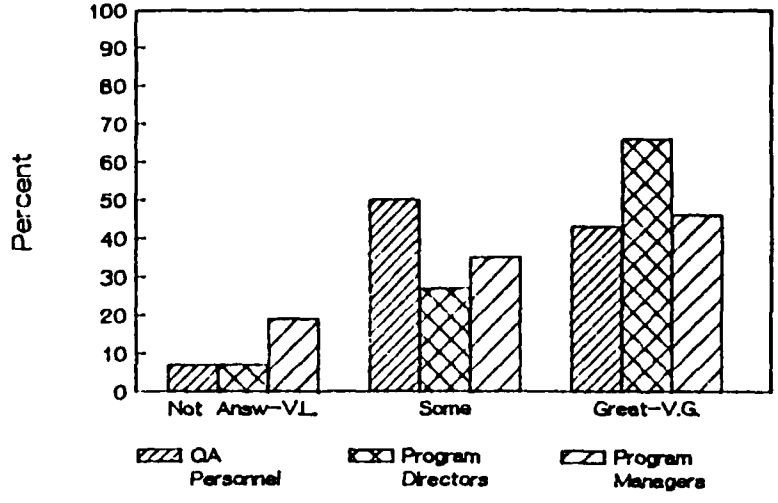


Figure 26. Influence the Contractor Using Contract Requirements.

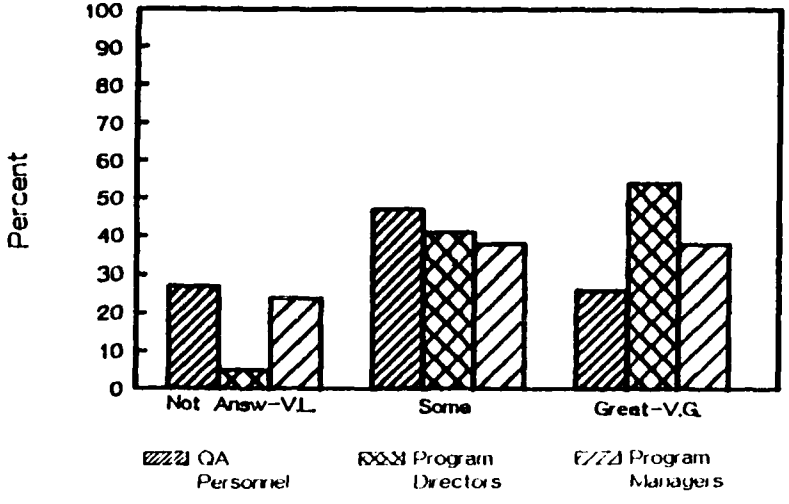


Figure 27. Influence the Contractor Using Good Business Practices.

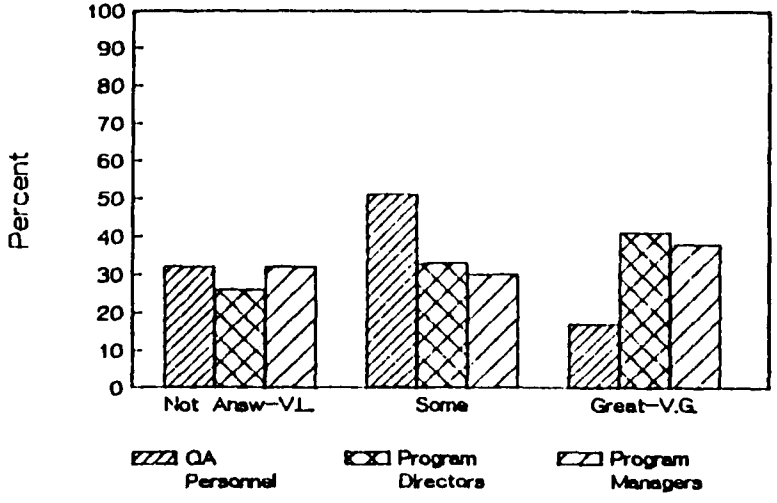


Figure 28. User's Influence on Contractor's Quality of Hardware/Services.

An equal number of the program directors and managers indicate that the user influences quality a great deal. However, only 15% of the QA personnel give this response.

When asked whether an award-fee or FFP contract would influence contractors to provide a quality product, more than 50% of program directors indicate an award fee would greatly influence the contractor (figs. 9 and 10). The respondents are very consistent in indicating that an FFP contract would do very little to influence the contractor to provide a quality product. Approximately 40% of the respondents say that warranties would greatly influence their contractor (fig. 29). However, 30% of the program managers and QA personnel indicate that a warranty would do very little to influence the contractor.

About 50% of the program directors and managers feel that good contract requirements and business practices can motivate the contractor to provide a quality product. The QA personnel agree that good contract requirements can motivate the contractor but they do not agree that good business practices are as effective. Many responses indicate that the user is not very effective in influencing quality and possibly should become more involved. Approximately 40% of the respondents indicate that warranties and award fees would greatly influence the contractor and more than 50% say that FFP contracts would do very little to influence the contractor to provide a quality product.

Impact of Quality Problems

The respondents are asked to what extent the number of quality problems in the last year are normal for their program. Approximately 40% of the respondents say they are having the normal amount of problems for programs as complex as theirs (fig. 30). In a related survey question, 30% say they have had no significant quality problems which impacted cost or schedule, or caused an accident, or gave unwanted publicity (fig. 48). However, 40% say they have had from one to three significant problems.

Fifty percent (50%) of the respondents indicate that manufacturing errors have some impact on managing the system while 45% of the program managers indicate these errors have very little effect (fig. 31). Many respondents say that engineering errors cause some problems, but 30% reported that they have very little impact on managing the program (fig. 32).

The responses to questions about the extent to which design and manufacturing problems impact schedule, cost, performance, and reliability (fig. 33) show two things. First, the QA personnel say in significantly higher numbers than program directors or managers that these items are greatly affected by design and manufacturing problems. Second, approximately 50% of the QA respondents indicate that design and manufacturing problems have greatly affected schedule, but the program directors and managers indicate that schedule has not affected quality of the product (fig. 13). In short, program directors and managers are saying

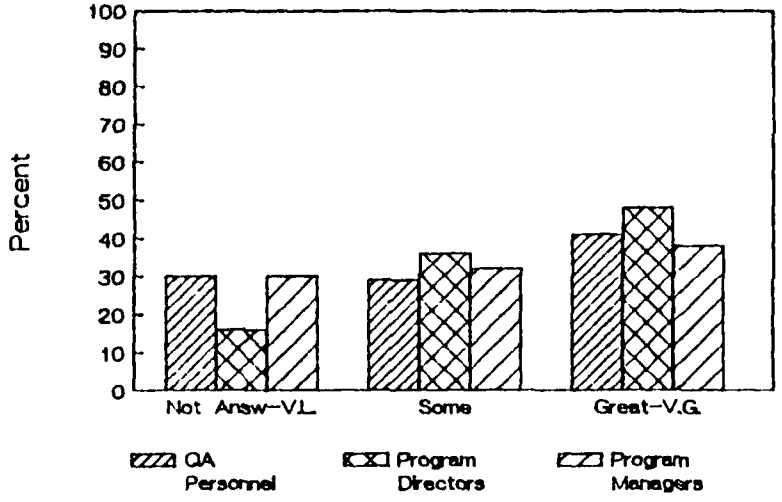


Figure 29. Influence the Contractor Using a Warranty.

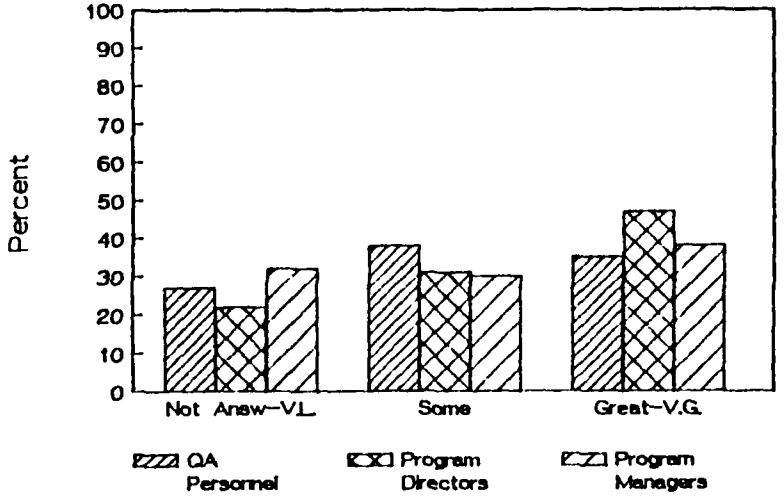


Figure 30. Normal Number of Quality Problems over the Last Year.

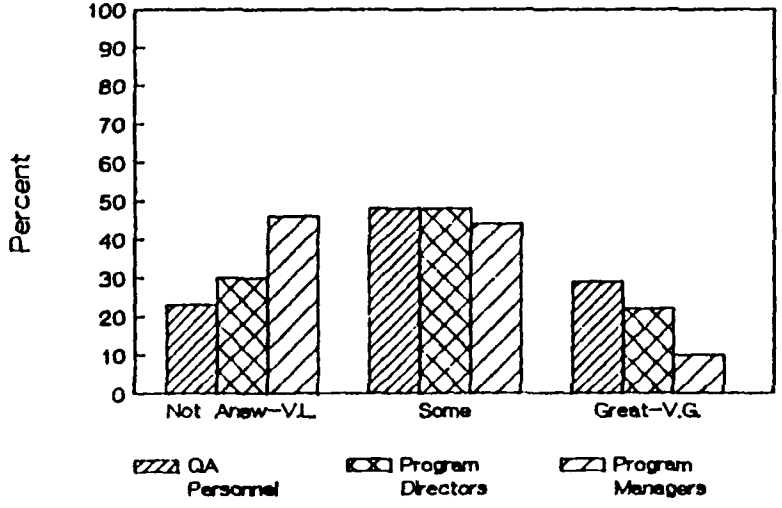


Figure 31. Manufacturing Errors Causing Management Problems.

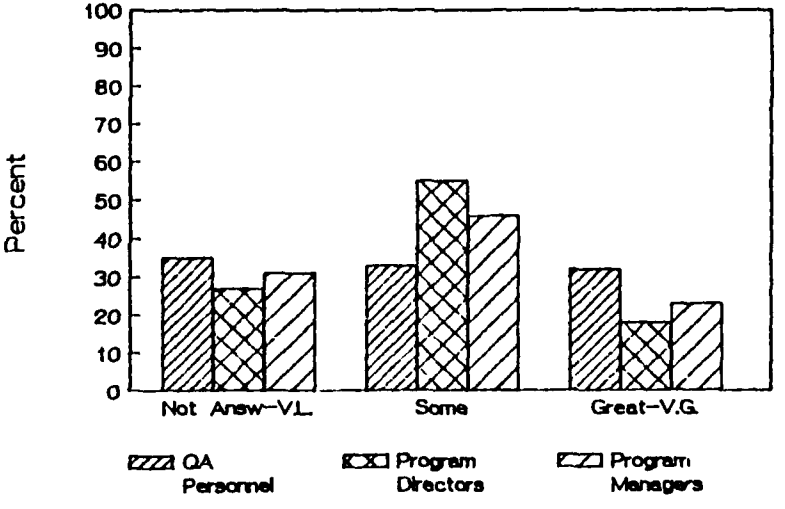


Figure 32. Engineering Errors Causing Management Problems.

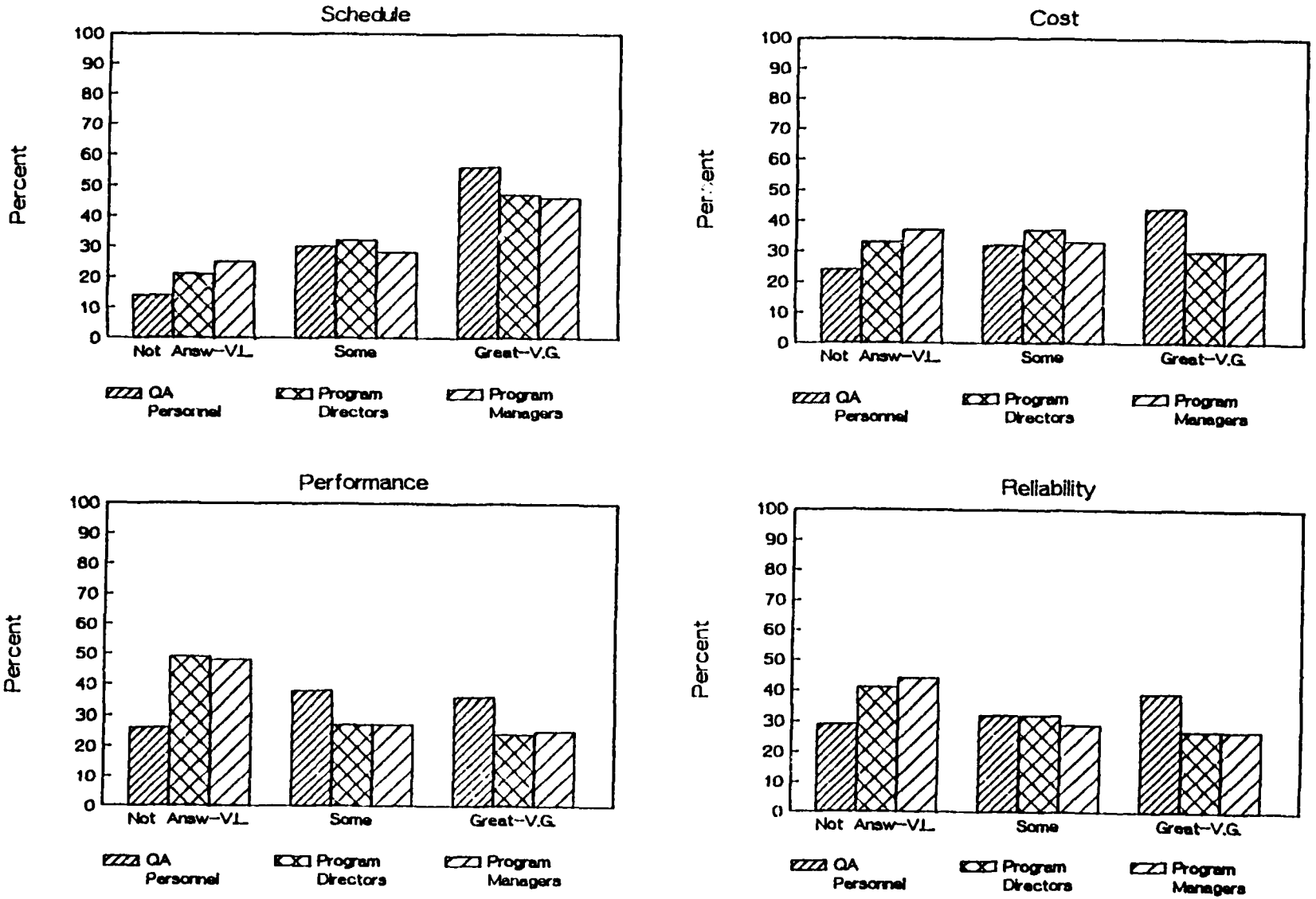


Figure 33. Design/Manufacturing Problems Effect on Schedule, Cost, Performance, or Reliability.

quality decisions are not being overridden by schedule; QA personnel do not agree, however. With respect to the extent to which the SPOs use hardware quality audits, about 45% of the respondents indicate that they are using these audits a lot and another 30% indicate they use audits at least some of the time (fig. 34). Although most in the QA work force are aware of the quality of their products, the data does not indicate any excellence in the product.

The majority of respondents indicate that they are not having major quality problems but do have some manufacturing and engineering problems. The majority also indicate that design and manufacturing problems have little impact on schedule, cost, performance, and reliability. However, schedule and, to a lesser degree, cost are affected to a greater extent than performance and reliability. This belief may indicate only that cost and schedule are more visible and easier to measure than performance and reliability.

Using Quality Improvement

The respondents are also asked to assess to what degree they are using a continuous quality improvement (QI) process. Quality improvement is as much a philosophy as it is a practice, and it must start with a serious commitment from top management. More than 70% of the program directors indicate that quality is the most important program objective (fig. 3). However, only 50% of the program managers and 40% of the QA personnel agree. If the program directors are committed to high quality, they have to communicate that commitment to the workers. One way is through educational programs. However, 50% of the program managers and QA personnel indicate that the SPOs use few educational programs aimed at excellence in management and technical fields (fig. 7). Also the SPOs must communicate this commitment to the contractors. The program directors are significantly more positive than the program managers and QA personnel in saying that they stressed quality objectives in dealing with contractors (fig. 35). More than 75% of the program directors indicate that the contractor does share the same quality objectives but less than 50% of the program managers and QA personnel agree. Most program directors (65%) thought a lot of team building was taking place in the system program office (SPO), in contract administration service (CAS), and at the contractor, but less than 40% of the program managers and QA personnel agree.

If SPOs are committed to improving quality, they must set measurable goals against which to judge progress. Yet, more than 50% of the respondents indicate that the SPOs have very few measurable goals (fig. 36). When asked to what extent the SPO is monitoring performance to goals, approximately 45% of the respondents say that it is doing so to a great extent (fig. 37). This result is interesting because the respondents previously say that they have few measurable goals. Approximately 30% of the respondents say they are measuring performance against an agreed-upon stan-

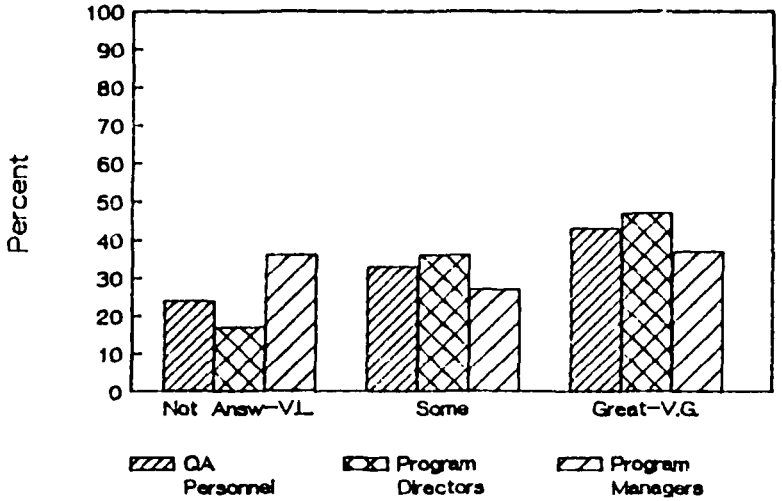


Figure 34. SPO Using Hardware Quality Audits.

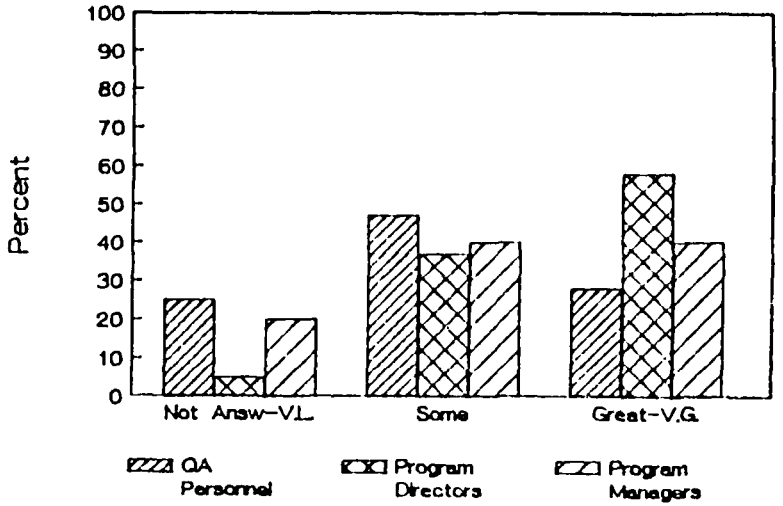


Figure 35. Contractor Shares Your Quality Objectives.

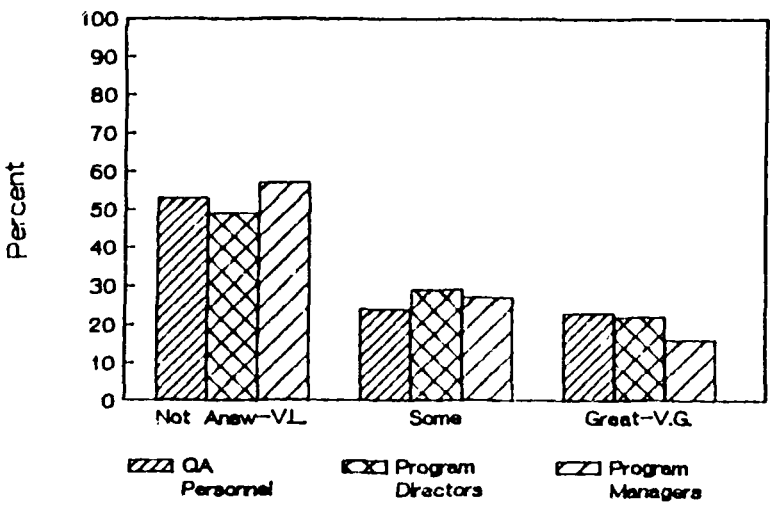


Figure 36. Measurable Quality Improvement Goals Defined by Your Organization.

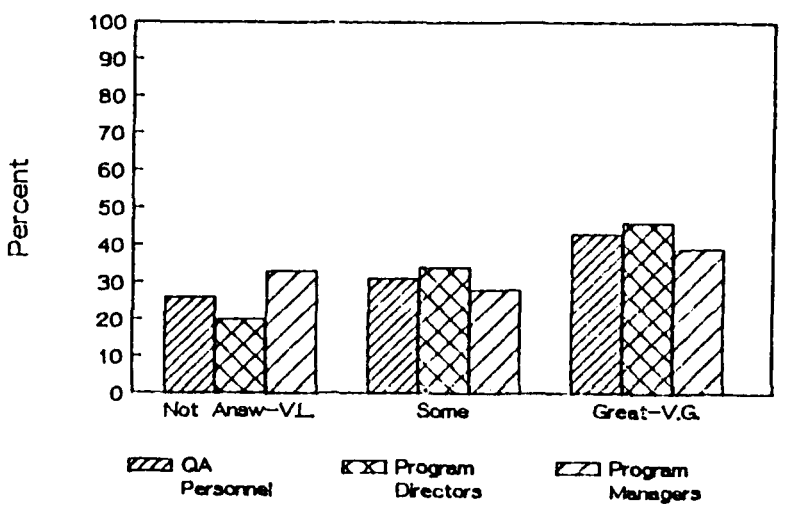


Figure 37. SPO Monitor Performance to Goals.

dard to a great extent (fig. 38). An equal number of program managers and QA personnel indicate that very little is being done in this area. More than 40% of the program directors and 50% of the program managers and QA personnel indicate that they are only infrequently comparing planned to actual work hours. Furthermore, more than 30% of the program managers and QA personnel indicate that they are not using this data at all (fig. 39).

When asked to what extent quality personnel focus on defect prevention rather than detection, the respondents show significant disagreement on the topic. Only 20% of the program managers and 35% of the program directors say that QA focuses to a great extent on defect prevention (fig. 40). However, 55% of the QA personnel say their primary focus is on prevention. Approximately 25% of the program managers do not answer this question (do not know where the focus is).

As discussed earlier, approximately 40% of the program managers and QA personnel think very little resources were being expended to improve quality (fig. 4). This outcome correlates with the fact that more than 40% think that the SPO uses very little producibility funding to reduce risk (fig. 2). Only 30% of the program managers and QA personnel and 41% of the program directors indicate the SPOs are using quality indicators to a great extent (fig. 41). An equal number also say they are using indicators very little.

Quality improvement appears to be an important program objective and is one that contractors seem to accept. Although the SPOs define few measurable QI goals, they do, to some extent, monitor performance against the goals that are established. Also, the SPOs measure contractor's performance against quality standards to a limited degree but are not looking at planned versus actual work-hour data. Finally, most QA people use indicators and measures of quality only to some extent, which indicates that the quality improvement process is not well established in AFSC.

On the average, only about 30% of the work force perform those tasks that can greatly increase quality. The product division staffs and Headquarters AFSC leadership are doing very little to help the SPOs increase the level of product quality. Warranties and award-fee contracts are ways to motivate the contractor to provide better quality but a firm-fixed-price contract will not do so. Also, the users have not been very effective in influencing the contractor to provide better quality. In general, quality problems have not affected program management to a great extent. Although some design and manufacturing problems affect cost and schedule to some extent, they have little impact on quality. People working in the SPO are not using the QI process to any great extent. They have few measurable quality goals to work with, and they use such indicators of quality only to some extent.

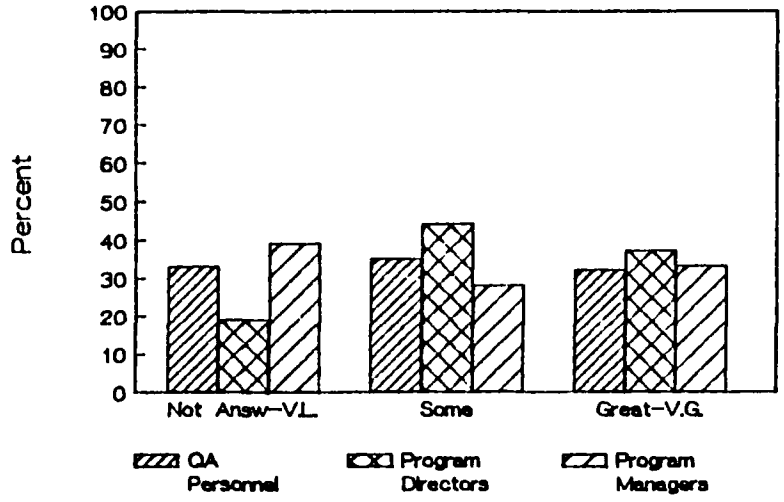


Figure 38. Contractor Performance Measured against Quality Standards.

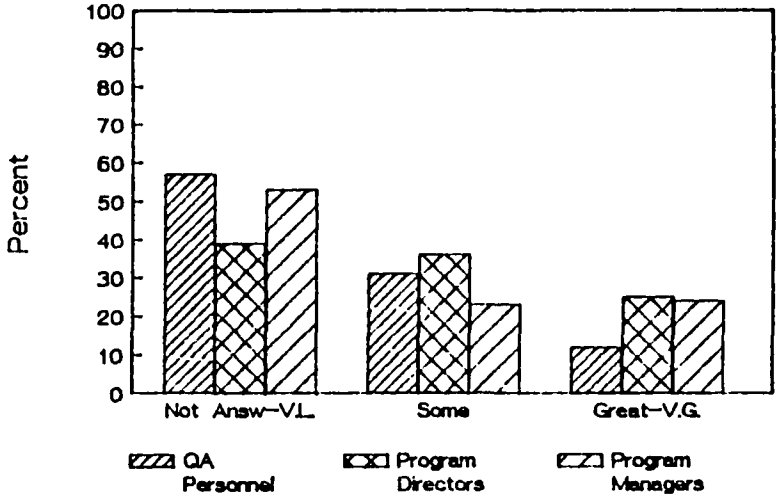


Figure 39. Comparison of Planned versus Actual Work-Hour Data.

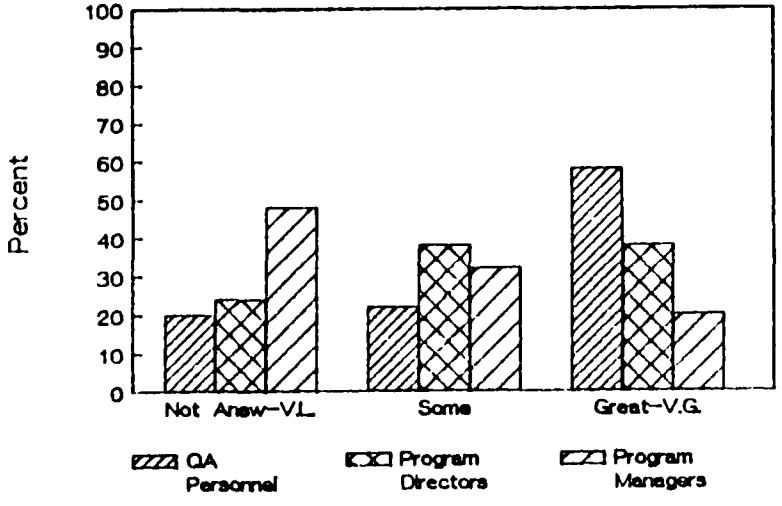


Figure 40. Quality Personnel Focus on Defect Prevention versus Detection.

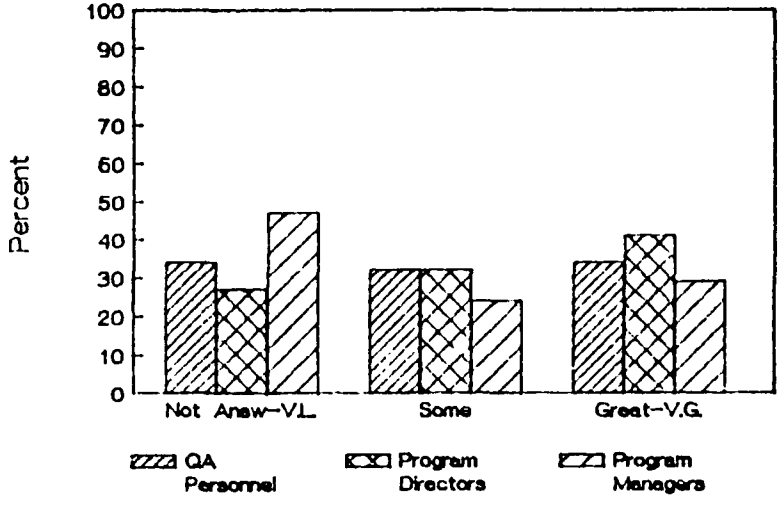


Figure 41. Use of Measures and Indicators of Quality.

What Is the Contractor Doing to Affect Quality?

If contractors are going to control the "hidden factory" costs discussed earlier, they must implement a total quality management (TQM) approach with a continuous quality improvement program. TQM means a totally integrated management process focused on quality improvement in every organization and function, not just for hardware in the production phase. Under a TQM approach, everyone is responsible, not just the quality organization, to assure a quality product, whether it is hardware, software, or paper products.

Several survey questions focus on the TQM philosophy and one specifically asks if the contractor is using this approach. TQM is not defined in the questionnaire and approximately 30% of the respondents indicate either they do not know what the contractors are doing or that they believe that the contractors are doing very little in TQM (fig. 42). Nearly 40% of the program directors but only 25% of the program managers and QA personnel indicate that contractors are doing a lot in total quality management. However, the majority of the respondents think quality is an important objective (fig. 3) and the contractors share our quality objectives (fig. 35).

Since TQM is not defined, several survey questions ask about the contractor's involvement with TQM. Approximately 55% of the program directors, but only about 30% of the program managers and QA personnel, say the contractor's top management is influencing quality to a great extent (fig. 8). Forty-five percent (45%) of the program directors and QA personnel indicate contractors are using employee motivation to some extent (fig. 43). Thirty percent (30%) of the program managers fail to answer this question (do not know what the contractor is doing). Fifty-five percent (55%) of the program directors and 30% of the program managers and QA personnel indicate that the contractor emphasizes supplier's quality to a great extent. But 30% of the program managers indicate they do not know what the contractor is doing and 30% of the QA personnel indicate they either do not know or the contractor is doing very little to assure that the supplier is providing quality (figs. 19 and 20). Forty percent (40%) of the program directors and QA personnel indicate that the contractor has a preferred vendor program with ratings on quality and schedule (fig. 19). However, only 25% of the program managers agree with this rating and another 25% indicate they do not know if the contractor has a vendor rating program.

When asked whether contractors have an active QI program based upon continuous evaluation, 40% of the program directors and QA personnel say that the contractor uses a QI program to a great extent (fig. 44). Only 25% of the program managers agree with this assessment while another 25% say they do not know if the contractor has a QI program. At the same time, 55% of the program managers and 45% of the QA personnel say contractors have done very little in conducting subcontractor QI programs. More than 25% of the program managers do not answer this question (do not know if the contractor is conducting subcontractor QI programs).

The use of subcontractor QI programs as a means of achieving better quality is not being used adequately by the contractors. Forty-five percent (45%) of the QA personnel and 50% of the program managers (25% did not answer) say design teams to achieve quality improvement are being used only to a very little extent (fig. 15). Experts in quality say the use of statistical process controls (SPC) is a must to realize true improvements. Yet approximately 55% of the program managers and QA personnel and 40% of the program directors say SPC techniques are being used only to a very little extent (fig. 45). Approximately 15% of the QA personnel, 25% of the program directors, and 35% of the program managers do not answer this question (again, indicating they do not know the answer). When asked to what extent contractors use measures or indicators of quality, 19% of the QA personnel, 27% of the program directors, and 38% of the program managers do not know if the contractor is using various indicators of quality (they did not answer the question). Also, only 25% of the program managers and QA personnel say these indicators were being used to a great extent (fig. 46). Almost half of the program managers, 36% of the quality assurance personnel, and 24% of the program directors indicate either they do not know what the contractor is doing or that the contractor is doing very little to improve quality in the areas questioned. About 40% of the program directors say the contractors are doing a lot in this area, but only 25% of the program managers and QA personnel reach this conclusion (fig. 47).

A significant number of people in the work force indicate they do not know what the contractor is doing, which should concern Headquarters AFSC. The majority of the respondents say contractors are using a TQM approach only to some extent, not a strong endorsement for TQM. Only about one third of the respondents indicate that the contractors use an active QI program to a great extent and less than 20% indicate the contractors are using statistical process control to a great extent. Finally, the majority of the work force indicates that quality indicators are being used at least to some extent, but a significant number do not know if the contractor is using these indicators.

Are Indicators of Quality Being Used?

One of the problems many people have with quality is the perceived difficulty in defining and measuring what is good quality. This difficulty is implied in the discussion, in chapter 1 above, of Guaspari's book *I Know It When I See It: A Modern Fable about Quality*. It is also expressed in research question two when the respondents rank the nebulous definition of quality as the fifth most important detractor of quality and productivity. However, the level of quality can be associated with measurable manufacturing and design parameters. These include reliability and maintainability data, production yield rates, test yields, and scrap, rework and repair rates, because as these parameters "go bad" so goes quality. The survey ques-

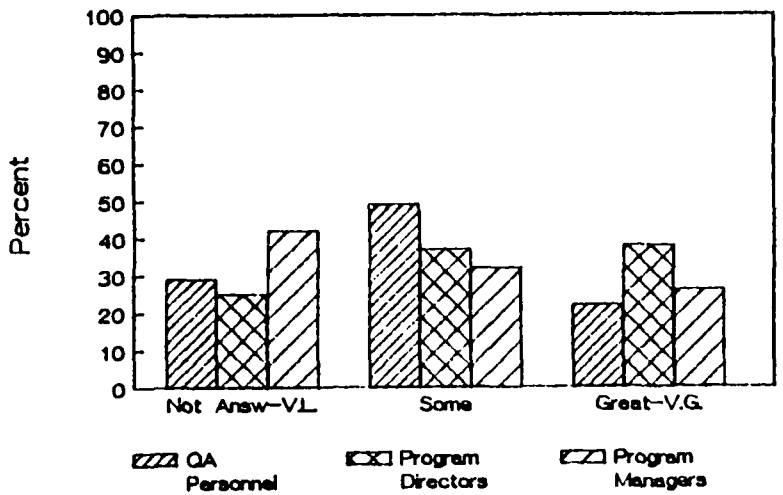


Figure 42. Contractor Using a Total Quality Management Approach.

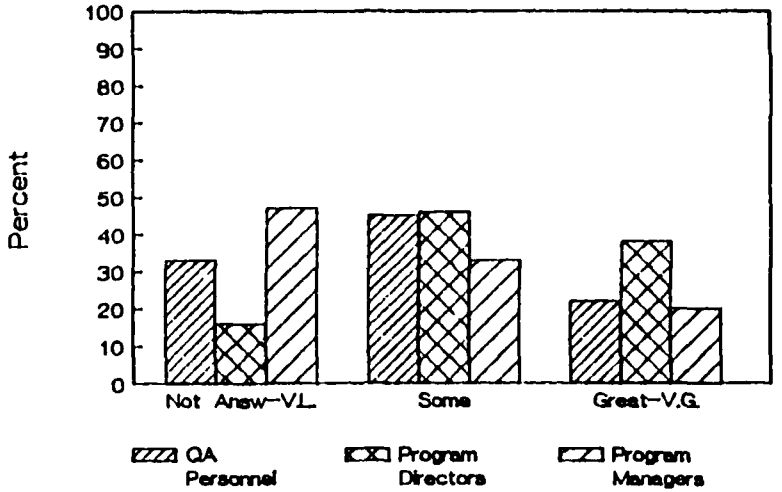


Figure 43. Contractor Using Employee Motivation Techniques.

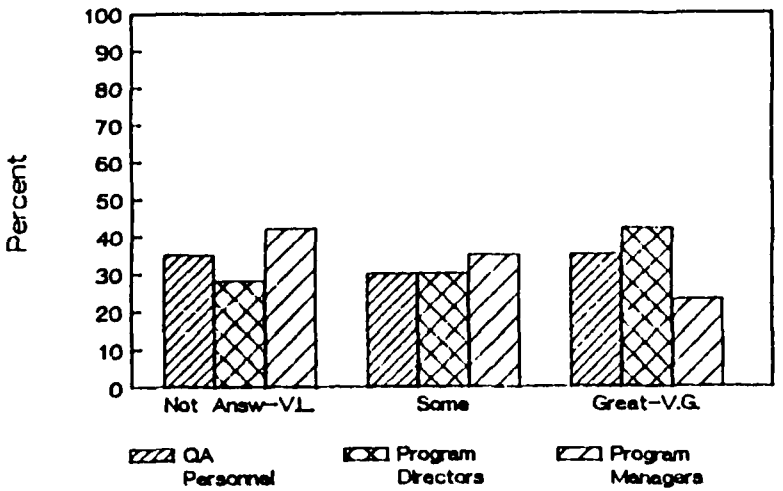


Figure 44. Contractor Instituted an Active Quality Improvement Program.

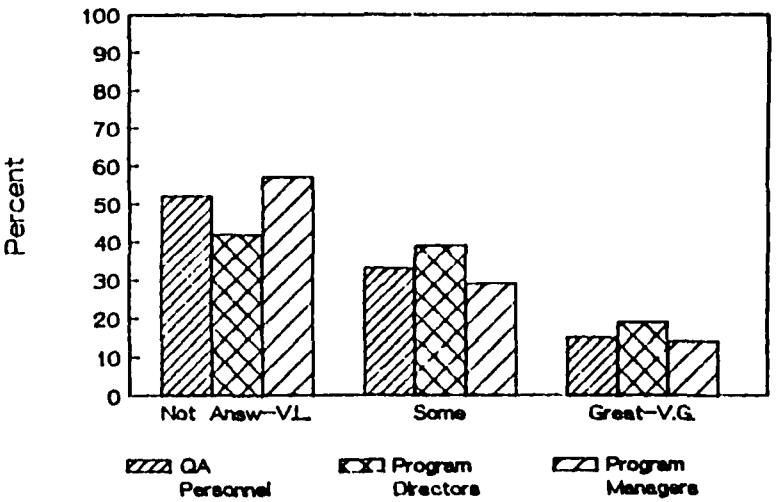


Figure 45. Contractor Using Statistical Process Control Including Vendors.

tionnaire addresses to what extent the SPO is using some of these indicators.

First, respondents are asked to indicate how good or bad they think quality is in AFSC and to state to what extent a few specific indicators of quality are being used. When asked how many quality of conformance problems had significant program impacts (schedule, cost, accident, publicity, etc.) during the past year, 30% say they have no significant quality problems while 40% have had one to three quality problems over the last year that had major impacts on the program (fig. 48). Many respondents (40%) think the number of quality problems are normal for a program of their complexity (fig. 30). Approximately 60% of the program directors and 50% of the program managers say quality has very little impact on delivery schedules (fig. 13). However, 40% of the QA personnel say quality affects delivery schedules to a great extent. When asked to what extent manufacturing and engineering errors cause problems, approximately 50% of the respondents say they do cause some problems in managing the program (figs. 31 and 32). Each of these items is a general indicator of quality and can and should be monitored for trends and repeated occurrences of the same problem. For example, a trend analysis of manufacturing and engineering errors can indicate if quality of design is improving or stabilizing. Any quality problem causing major program impact should be an obvious indication of poor quality and a lack of control.

This research also seeks to determine to what extent the work force is using five specific indicators of quality. One strong indicator of quality is the commitment to design quality into the product. Sixty percent (60%) of the program directors but only about 30% of the program managers and QA personnel indicate they are designing quality into the product (fig. 1). When asked to what extent field performance data is used to indicate or measure quality, almost 50% of the respondents indicate they use field data to a great extent (fig. 49). However, 15% of the program managers and 18% of the program directors fail to answer this question. Forty percent (40%) of the program directors and 50% of the QA personnel and program directors indicate that they seldom compared planned to actual work-hour data (fig. 41). Approximately 50% of the program directors and QA personnel indicate they are monitoring defects and workmanship data (fig. 6). Only 30% of the program managers gave this response and 40% say they are monitoring this data to a very little extent. Fifty percent (50%) of the program directors and QA personnel and 65% of the program managers indicate that they use subcontractor yield data to a very little extent (fig. 18).

The respondents are also asked to assess to what extent they think the contractor is using indicators of quality. Approximately 40% of the QA personnel and 30% of the program directors and managers say cost, schedule, performance, and reliability affect design and manufacturing problems to a great extent (fig. 33). When asked to what extent a contractor uses product return rates (cost to rework) as an indicator of quality,

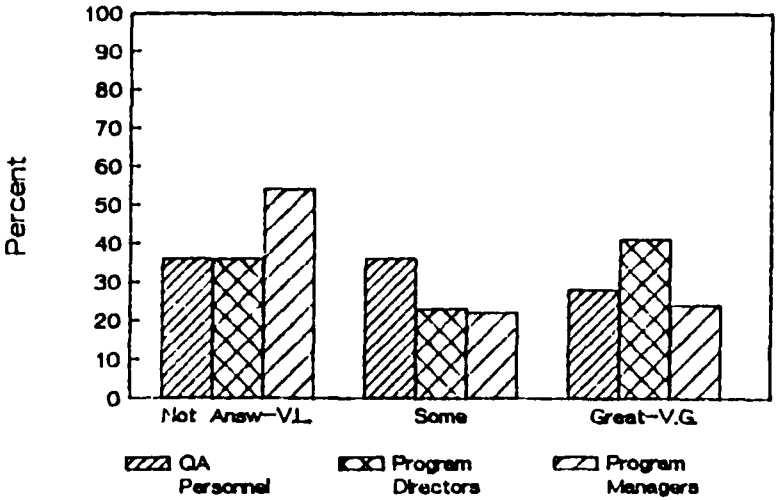


Figure 46. Contractor Using Indicators and Measures of Quality.

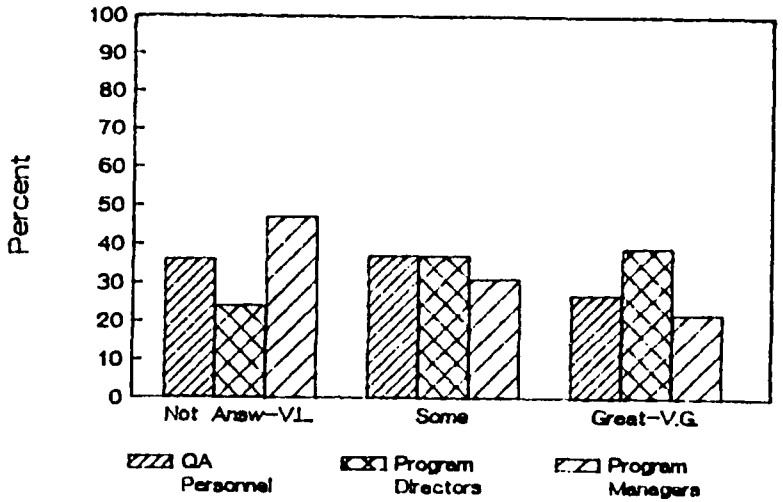


Figure 47. Contractor Affects Quality—Summary.

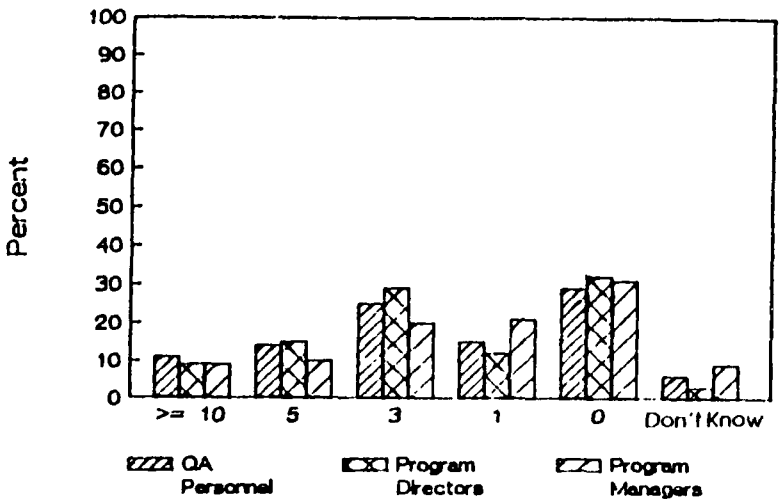


Figure 48. Number of Significant Quality Problems.

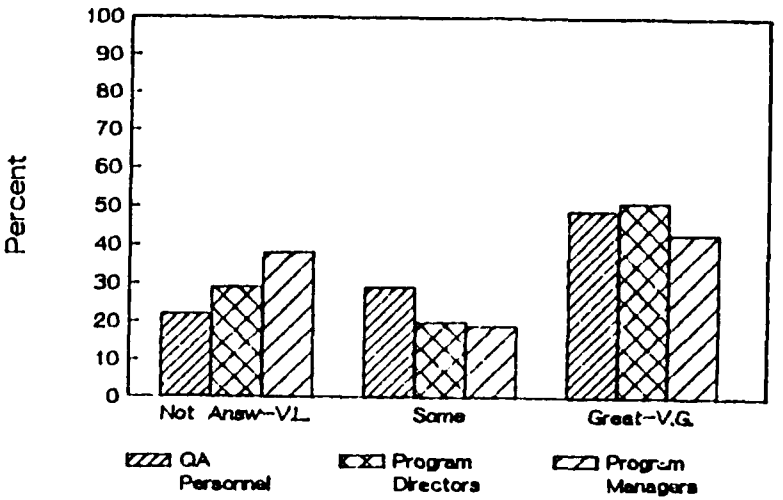


Figure 49. Using Field Performance Data.

approximately 40% of the program directors and QA personnel and 60% of the program managers say they either do not know or say the contractor is using this indicator infrequently (fig. 50). Twenty percent (20%) of the QA personnel, 27% of the program directors, and 41% of the program managers do not know if the contractor uses this indicator (they did not answer the question). Approximately 40% of the program directors and QA personnel and 60% of the program managers say either that they do not know or that the contractor is doing very little to standardize manufacturing processes (fig. 51). The number of respondents who do not answer is very similar to the previous question. When asked whether the contractor is using production yield rates as an indicator of quality, again approximately 40% of the program directors and QA personnel and 55% of the program managers either do not answer or say production yield rates are used to a very little extent (fig. 52).

Only 30% of the program managers and QA personnel indicate the contractors are using MRB/QDR action effectiveness (repeats) as an indicator of quality to a great extent. However, more than 50% of the program directors feel that contractors are using this data (fig. 5). A significant number, more than 20%, of the respondents do not answer this question. When asked whether they are using accept-reject rates at work centers, approximately 30% of the program directors and QA personnel and 50% of the program managers either do not answer or say this indicator is used to a very little extent (fig. 53).

One purpose of this research is to assess to *what extent the acquisition* work force in the SPO and the contractor are using indicators or measures of quality. Although a significant number of the respondents, approximately 70%, indicate they are using quality indicators at least to some extent, only 30–40% say they are using them to a great extent (fig. 42). Approximately 55% of the respondents indicate that the contractor is using quality indicators to some extent, but again only 30–40% say they are using them to a great extent (fig. 46). The significant number of respondents who do not answer (because they do not know the answer) should be of concern to Headquarters AFSC.

Are SPO Personnel Using Cost of Quality Data as a Program Management Tool?

Another aim of this research is to determine to what extent the work force knows what the cost of quality is on their program and to determine if they are reviewing that data. This data is important since these costs add no value to the product and are estimated by experts in industry and government to be as high as 35% of sales. These costs offer a tremendous opportunity for increasing productivity and reducing costs to those firms that have begun to use cost of quality concepts as a management tool. As indicated earlier, most respondents say they have had one to three significant quality problems over the last year (fig. 48). These types of problems

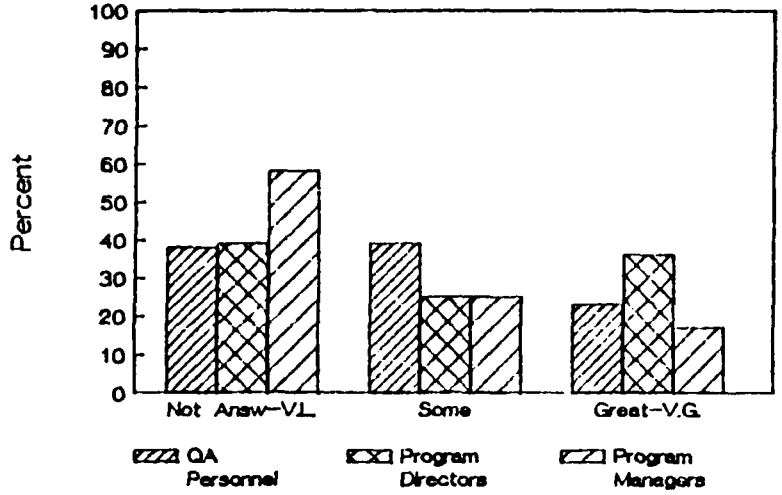


Figure 50. Product Return Rate (Cost to Rework) as a Quality Indicator.

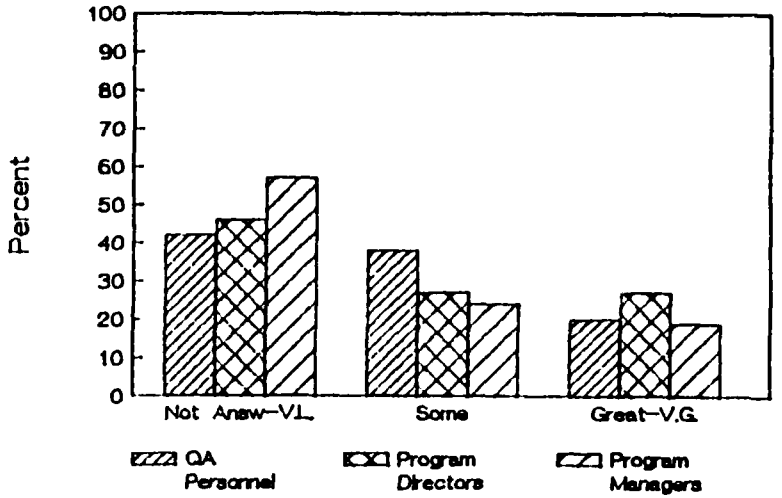


Figure 51. Degree of Manufacturing Process Standardization as an Indicator.

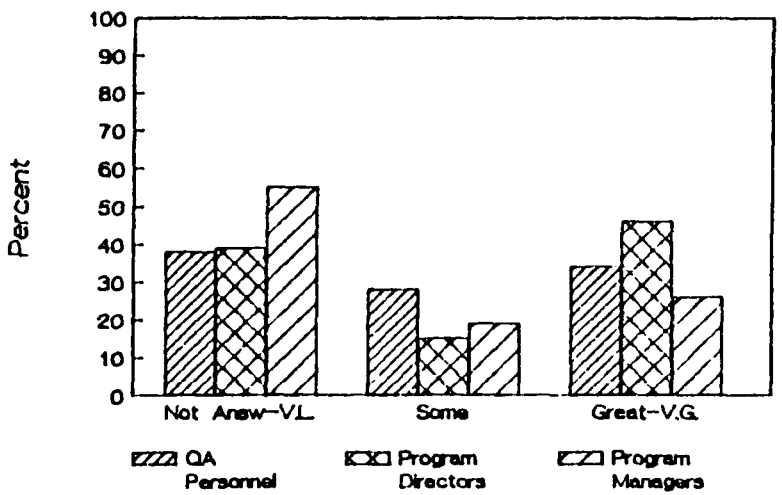


Figure 52. Production Yield Rates as a Quality Indicator.

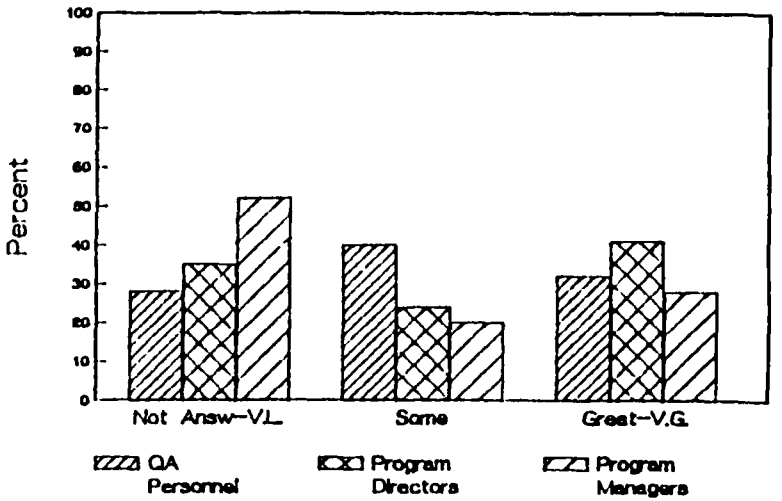


Figure 53. Accept or Reject Rate at Work Centers as a Quality Indicator.

usually indicate serious quality problems and increase costs to the government and contractor. When asked how often they review user-complaint data and trends, a significant number of the program management and QA personnel say they never review user-complaint trends. However, the majority of the respondents indicate they do review user data (fig. 54) and do use field performance data (fig. 49). Many respondents—20% of the program directors and QA personnel and 50% of the program managers—indicate they never review contractor's scrap, rework, repair, and retest data (fig. 11). This finding is alarming because in all likelihood the contract requires this data. When asked how often they personally review contractor's cost of quality (failure costs + routine inspection + prevention costs) data or trends, approximately 40% of the program directors and QA personnel and 60% of the program managers say they never review this data (fig. 12). (As a result of this high negative response, the confidence in the following data is very low.) Approximately 60% of the respondents indicate that the cost of quality is less than 15% of their contract value, and less than 10% say it is greater than 25% (fig. 55).

Next, the respondents are asked to break down the three components of the cost of quality and if they do not know to leave the question blank. The component costs are failure, inspection, and prevention costs. The largest single response, approximately 60%, indicate that they do not know what the individual costs are. A significant number, about 25%, say the total cost of quality is divided approximately equally between the three components (fig. 56). However, literature indicates that most of the companies using cost of quality concepts have not measured all components and have been focusing on failure costs because they are easier to measure. Similarly, when asked how much confidence they have in their cost of quality estimate, approximately 50% of the respondents do not answer (zero confidence in their estimate); many others indicate that they have less than 25% confidence in their estimate (fig. 57).

The data indicates that approximately one half of the work force never review scrap, rework, and repair data and the cost to the government for these items. Even if cost of quality data is being reviewed, it is not likely that the SPO personnel can separate this data into its components: failure, inspection, and prevention costs. Finally, the data indicates that the many members of the work force do not know the cost of quality for their program. The literature indicates that a major obstacle in using cost of quality data is getting supervisors to believe that these are true costs that can be reduced and avoided.[2]

Summary

This chapter summarizes the empirical findings from survey questionnaires sent to acquisition personnel at Air Force Systems Command's five product divisions. The objective of the questionnaires is to determine if AFSC acquisition personnel are aware of and using those indicators of

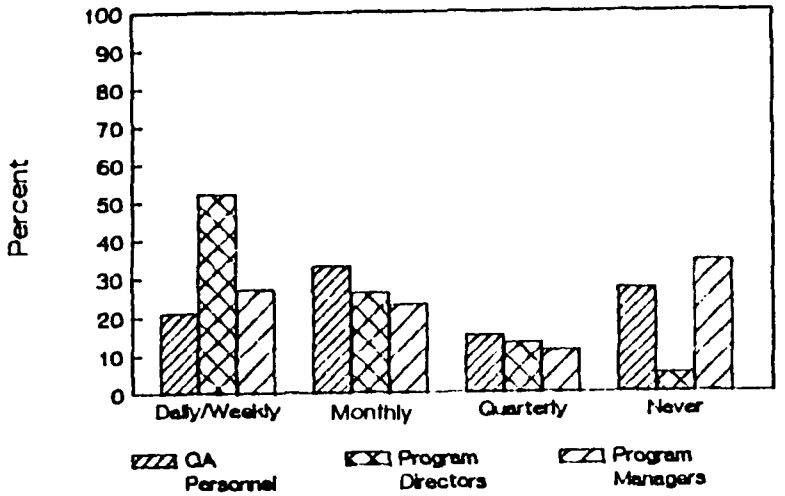


Figure 54. Review of User Complaint Data on System or Item.

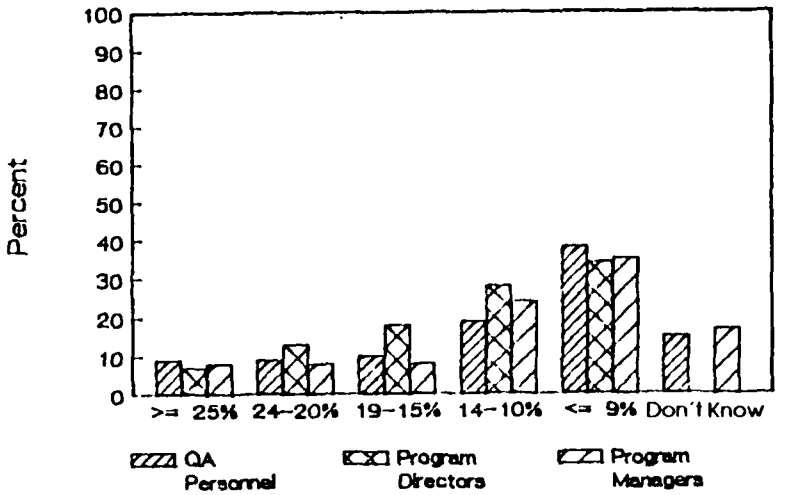


Figure 55. Cost of Quality Estimate as a Percentage of Contract Value.

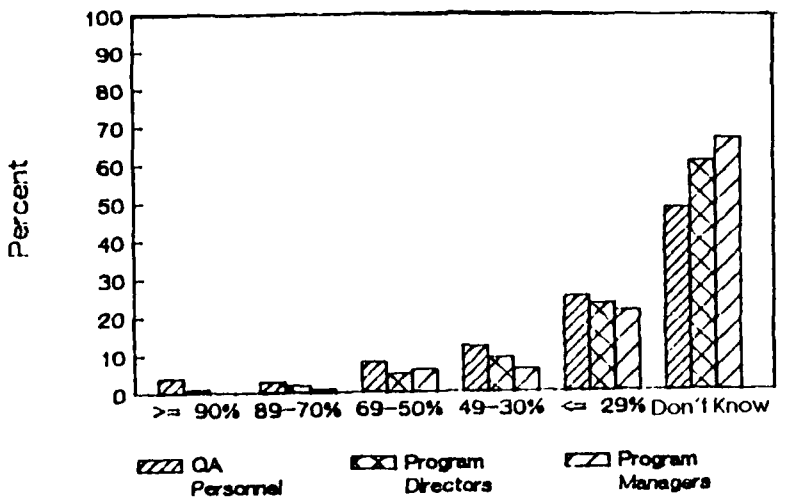


Figure 56. Estimate of the Cost of Quality Components: Failure, Inspection, and Prevention Costs.

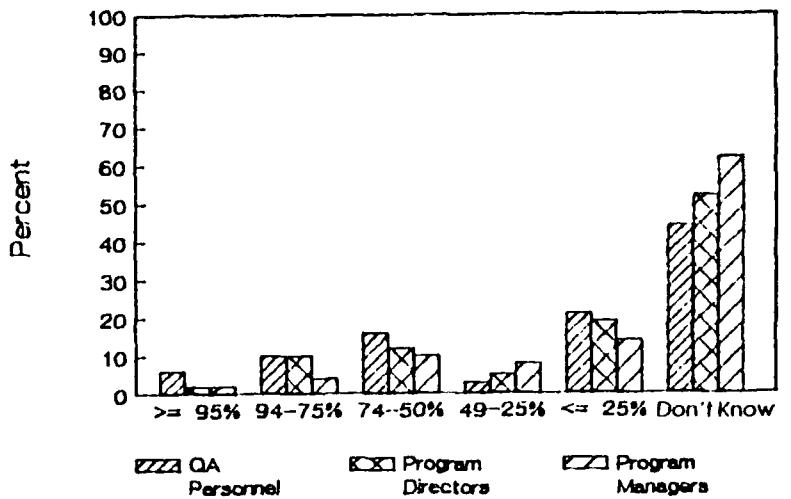


Figure 57. Confidence in Cost of Quality Estimate.

quality that more effectively identify nonconformances and are applying techniques to reduce incidences of nonconformance.

Notes

1. "Accountable Contract Management, AFCMD Review," briefing to the AFSC commander, December 1984.
2. Thomas C. Gibson, "The Total Quality Management Resource," *Quality Progress*, November 1987, 63.

CHAPTER 5

Summary and Recommendations

The acquisition work force must realize that often the Defense Department is paying too much for the products and weapon systems it acquires. This work force must take appropriate action to reduce the cost of those products and systems. Some critics have estimated that the Defense Department has been paying a significant portion of its procurement budget (20-30%) to contractors for costs that add no value to the item. Until very recently, the Defense Department and the aerospace industry have paid little attention to these costs, termed as the *hidden factory* by General Marsh in 1982. But this situation is changing now that high-level DOD personnel are becoming more aware of the significance of these costs and now that DOD is experiencing a reduction in its budget. The objective of this study is to determine if Air Force Systems Command (AFSC) acquisition personnel—the program directors, program managers, and quality assurance (QA) personnel at the five AFSC product divisions—are aware of and using those techniques that more effectively identify nonconformances and are applying techniques to reduce incidences of nonconformance. This researcher uses a questionnaire to determine to what extent the work force really understands what these costs are and to determine the extent to which it is using this data to manage programs.

The overall response rate for the questionnaire was about 35%. The rate of response can be indicative of the level of interest in the topic on the part of those surveyed. The response in this study can provide a statistically accurate estimate of the population with a 95% confidence level and an error rate of less than 10%, which is considered an acceptable level for this type of data. The response for each subpopulation (program directors, program managers, and quality assurance personnel) appears to be representative of each respective group. The "typical" program director is a colonel with more than 10 years of acquisition experience. Ninety-four percent (94%) manage programs that are in the full-scale development or production phases. The "typical" program manager is a captain with less than three years of acquisition experience. Only 16% work on systems in the conceptual or demonstration-validation phases. The "typical" QA civilian is a GM-12 engineer with 10 years of acquisition experience and the "typical" QA military officer is a first lieutenant with an engineering degree. Only 16% of the QA personnel work on programs in the conceptual or demonstration-validation phases.

The data strongly indicates that there is a lack of communication among the acquisition work force. The findings graphically show the magnitude of how the three subpopulations answer various questions differently. A one-way analysis of variance test using a 95% confidence level reveals that all three subpopulations agree on only 17 of 59 possible questions. The program directors and QA personnel agree on 24 of 59 questions. The program managers and QA personnel agree on 40 of 59 questions; and the program directors and program managers agree on 19 of 59 questions. Additionally, the program directors consistently answer questions more positively than the other two subpopulations. This outcome may result because the directors are more informed, experienced, or optimistic individuals, or because the program managers and QA personnel know the problems of the systems, yet do not report the bad news up to the next layer of the bureaucracy.

A significant problem also exists when 15-20% of the QA work force cannot answer many basic questions concerning what a contractor is doing with respect to quality improvement. This finding needs to be investigated further by Headquarters AFSC. The problem may be a lack of focus on the correct tasks, but it is probably a lack of available manpower and training. Approximately 15-20% of the program directors and an even greater number of program managers (as high as 40%) do not answer many of the survey questions addressing the subcontractor. This outcome is surprising considering the attention Headquarters AFSC has put on subcontract management over the last few years.

The data additionally indicate that total quality management (TQM) with continuous quality improvement is not well understood or practiced throughout the work force. Publishing requirements to adopt TQM will do little good within DOD unless the work force is educated as to the value of adopting it. Program directors and managers must understand that quality begins with involvement and commitment to not accept poor quality. To meet this goal, these acquisition personnel must understand principles of TQM and continuous quality improvement. They must understand that costs are often too high and that the Air Force and DOD are often not getting quality products. This fact is true regardless of the acquisition phase, type of contract, or even if the product is a commercial off the shelf item.

How Have Past Studies Addressed This Topic?

Quality assurance has been of continuing concern to the Air Force the last couple of decades. During the last 10 years, AFSC has conducted several major reviews of quality assurance (QA). In the previous 15 years, the Defense Department and Air Force have done some 20 studies on quality assurance. Several significant changes to the quality assurance function have resulted from the recommendations of these studies. The current study reaches many of the same conclusions as several of the past studies.

These include a need for Headquarters AFSC to establish a clear and firm policy of not accepting poor quality; the need to use scrap, rework, and repair levels with cost data to manage contractor performance; the need to use more positive incentives to motivate the contractor to deliver better quality; and the need for better education and training for QA personnel. These findings and recommendations have been around for at least 10 years and some even longer.

What Are the Most Important Factors Affecting Quality?

The survey asks the acquisition work force to indicate what are the most important factors affecting quality. One question asks the respondents to rank the top contributors to quality and another asks them to rank the top detractors from quality. The respondents identify the three top contributors to a quality product as early inputs to the design (producibility, manufacturing, and quality), commitment to not accepting poor quality, and program stability. They list the top three detractors to quality as unrealistic program schedules, lack of cooperation among personnel, and program instability. They indicate that quality is an important program objective and that they are using a development process that designs quality into the product to some extent. However, in answers to several other questions, the work force indicates that it is accomplishing very few of the important contributors to a quality product to any real extent. These include producibility funding, educational programs, team building, using design teams, and establishing and monitoring quality goals.

Secretary of Defense Frank Carlucci has recognized and endorsed the need for a "cultural change and fundamental redefinition to how our institutions deal with quality." Much of the data presented in chapter 4 indicates that the work force does not understand this new definition of quality (total quality management). The high percentage of questions that were answered "to some extent" indicates a lack either of commitment or understanding of TQM and the continuous quality improvement process. For AFSC to achieve the quality revolution that General Marsh referred to in 1982, 70-80% of the responses should have been in the "great to very great extent" categories.

What Is the System Program Office Doing to Affect Quality?

Another focus of this research is to determine the effectiveness of the QA organization in the system program office (SPO), the effectiveness of motivational techniques to improve quality, the degree to which quality problems are affecting program management, and the degree to which the SPO is using the continuous quality improvement process. The QA work force is only somewhat effective in contributing to high quality products. The

responses indicate that this shortcoming is probably more a function of manning and training than of the relative importance of quality in the organization. The QA personnel disagree with the program directors and managers as to the effectiveness of various methods for influencing the contractor to deliver better quality products. Significantly more program directors and managers indicate that good business practices and user involvement in the acquisition process can influence the contractor to provide better quality. There is closer agreement on the effectiveness of contract requirements, warranties, and award fees and the lack of effectiveness of firm-fixed-price contracts. Most respondents indicate that design, engineering, and manufacturing errors do cause some problems in managing their program, but they feel that the number of quality problems is normal for complex programs. Approximately 50% of the respondents state that they have three or more significant quality problems a year. Hence, they expect to have some quality problems, and they feel that it is not unusual to face several significant quality problems. This attitude must change because the Air Force and AFSC can no longer accept the costs associated with acceptance of low levels of quality. Although the majority indicate that a contractor's performance is measured against quality standards at least to some extent, the responses indicate that the SPO has established few measurable quality improvement goals and the comparison of the contractor's planned versus actual work-hour data is being done to a very little extent. This data shows that those in the acquisition community are not universally practicing the continuous quality improvement process.

What Is the Contractor Doing to Affect Quality?

A significant part of the work force is not aware of what the contractor is doing with the quality improvement (QI) process or total quality management (TQM). This void is particularly evident in the area of what the prime contractor is doing with subcontractors. Most respondents say contractors are using a TQM approach only to some extent and only a third say an active QI program has been instituted to a great extent. Statistical process control (SPC) is a very important tool for an active QI process. However, only 20% say contractors are using SPC to a great extent.

Are Indicators of Quality Being Used?

Approximately 70% of the respondents indicate that the SPOs use some quality indicators at least to some extent, but only 30-40% use them to a great extent. Of those indicators listed in the survey, using field performance data is the most often selected item with almost 50% indicating they are using this data to a great extent. Over 50% indicate they are using subcontractor yield data to a very little extent or not at all. When asked to what extent the contractors use quality indicators, a significant number of respondents do not know if contractors are using quality indicators at all.

Only about 55% of the respondents indicate that the contractor is using quality indicators to some extent or more, the rest either do not know or indicate very little to not at all.

Are SPO Personnel Using Cost of Quality Data as a Program Management Tool?

Because of the importance of managing the cost of quality, several survey questions focus on this indicator of quality. A significant number of the respondents (20% of the program directors and QA personnel and 50% of the program managers) indicate they never review the major components of this cost: scrap, rework, and repair levels. An even larger number (45% of program directors and QA personnel and 65% of the program managers) say they never review the cost associated with these items. If AFSC is to reduce "hidden factories," it must recognize scrap, rework, and repair as true costs and it must recognize that the magnitude of those costs is a major obstacle to achieving quality improvement (QI).

Recommendations

AFSC needs to demonstrate clearly its commitment to total quality management and provide strong leadership to ensure that TQM is implemented. Several recent examples indicate that both DOD and AFSC are moving toward a commitment to TQM. First, in April 1988, Daniel S. Rak, deputy assistant secretary of defense (acquisition management and policy), solicited comments from AFSC, among others, on three new DOD documents: *DOD Total Quality Management Master Plan*, DODD 5000.XX (*Total Quality Management*), and DODI 5000.YY (*Quality Program*). Rak's letter suggests that these documents on TQM will help bring about a cultural change and redefine how the acquisition community deals with quality. Second, the AFSC commander, Gen Bernard P. Randolph, issued a policy letter on reliability, maintainability, and producibility (RM&P) on 15 April 1988. This letter states that RM&P are key building blocks of TQM and continuous QI and instructs program directors to establish measurable RM&P objectives and to show how their project is reaching those objectives. Third, in a letter on total quality management in AFSC dated 12 May 1988, to which Secretary Carlucci's memorandum on TQM principles was attached, General Randolph states his commitment to make TQM "a way of life" in AFSC. He indicates he is sending 40 select, senior-level people from the headquarters staff to a four-day Deming Quality and Productivity Seminar on TQM. He also charges each field commander and staff to seek similar training.

Headquarters AFSC must show that its commitment to and leadership of the TQM effort does not change with personnel. The leadership's strong commitment to quality must be delivered to the product divisions and Air Force Contract Management Division (AFCMD) work force by actions, not

just words. The number of personnel who attend TQM seminars and their actions afterwards may become an indicator of this commitment. Requiring program directors to establish goals for the various quality indicators, such as the RM&P objectives, and to give briefings on their success in achieving them at program reviews would indicate command interest and commitment to improvement. This commitment to quality improvement can also be shown by increasing the number of QA personnel in the buying divisions. Slots can be taken from the Air Force Contract Management Division quality function or the Defense Department can show its commitment by authorizing new slots. However, increasing the number of QA slots without training would have minimal effect.

AFSC needs to increase education and training in total quality management. Almost every study in the past 20 years has reached the same conclusion, but little has been done to correct this serious deficiency. The 1986 DOD Authorization Act (PL 99-145, sec. 1624) requires mandatory training for personnel responsible for assuring quality in contractor facilities. This provision can very easily be interpreted to mean all acquisition personnel. However, the Air Force apparently has interpreted it to mean only quality assurance personnel located at the contractor's facilities. Additionally, at least one product division has interpreted the law as requiring training only for new hires below the grade of GS-11 or -12, since this grade is hired as "fully qualified."

This study indicates that most of the acquisition work force wants the training and education so that they will be more effective on their job, but they are getting little support from staffs and higher headquarters. In fiscal year 1988 only 31 training slots were allocated to AFSC for QA training out of a total AFSC QA work force of approximately 1,600. The only mandatory training that military QA personnel receive is that required by the law, and that may not apply to those working in the SPOs. Also, there is no focal point at Headquarters AFSC to advocate a training program for the military as there is for civilians. Headquarters AFSC is developing a mandatory civilian training program, but no one knows how much support it has at Air Force or DOD levels. Positive and visible action on this front is essential.

The specific recommendations for training are:

1. The program directors, managers, and engineering work force must be introduced to TQM. By far the most significant impact to quality can be made by these individuals, and therefore they should be the major focus of AFSC quality training. At Headquarters AFSC, the deputy chief of staff, product assurance and acquisition logistics (AFSC/PL), should review the content of acquisition courses, such as those taught by the Air Force Institute of Technology (AFIT) and the Defense Systems Management College (DSMC), and ensure that the curricula include material on TQM. The staff at AFSC/PL should periodically review these curricula to make certain that the course material is appropriate.

2. A training program must be established for the military and civilian QA work force. This program should be the responsibility of Headquarters AFSC, deputy chief of staff, product assurance and acquisition logistics. The unique requirements of each product division and Air Force Contract Management Division should be considered in developing this training program. If an adequate training program is not established for the military, then the Air Force should consider reassigning these officers to duties they have been trained to perform.

Additionally, AFSC needs to use more positive incentives to motivate the contractor to deliver higher quality and less expensive products. Several previous studies make this same recommendation. The work force has consistently endorsed the use of incentives for many years and the majority indicate in this study that both warranties and award fees would motivate their contractor to deliver better quality products.

The specific recommendation is that Headquarters AFSC, deputy chief of staff, product assurance and acquisition logistics, and the deputy chief of staff, contracting (AFSC/PK), develop an award-fee plan for quality assurance. In developing this plan, these offices should seek inputs from the functional areas at the product divisions to ensure applicability to the various products and acquisition phases. An example of an award-fee plan for quality was developed in the study *Contract Incentives for Product Quality*, but I suspect it has rarely been used. Once this plan is developed, the work force will have to be trained to implement it.

Last, as has been recommended in several previous studies, in order for manufacturers to really know what quality costs, they must start collecting and reviewing data that shows the costs of mistakes in design, manufacturing, and support. Since at least as far back as the 1977 quality study, the Air Force has recognized the need to obtain measurable data on quality, including both quality performance and cost data. The results presented in this study show clearly that little performance or cost data is being reviewed by SPO personnel. This finding is particularly disconcerting since DOD Directive 4155.1, *Quality Program*, and Air Force Regulation 74-1, *Quality Assurance Program*, require a quality history on the contractor to be maintained so that contracts will not be awarded to contractors who have a history of delivering poor quality products.

The specific recommendations are as follows:

1. Headquarters AFSC should require that the SPOs and AFCMD obtain contractor quality data, such as scrap, rework, repair, and retest data, as well as the cost associated with these items. Goals should then be established to try to reduce these items. The SPOs and AFCMD should be working with the product division staffs, Headquarters AFSC, and the contractor to ensure that the data is in a usable format and used as a program management tool.

2. To show commitment to TQM and continuous quality improvement, Headquarters AFSC should require that this data be briefed at the command-level program reviews.

3. Headquarters AFSC, Deputy Chief of Staff, Product Assurance and Acquisition Logistics, should develop an objective methodology to evaluate and monitor contractor quality performance. This DOD and Air Force requirement has historically been ignored by the command because the work force has not understood how to do it. Appendix A shows an example developed in a previous study that, although having a subjective rating scale, would provide a uniform format for assessing a contractor's performance. This example would be an acceptable format if the work force were given instructions on how to standardize ratings. Headquarters AFSC should then maintain summary data on each contractor and subcontractor.

Concluding Observations

The Defense Department and Headquarters AFSC have recently shown they have an interest in improving quality in order to reduce costs. Whether the true commitment is there to make this cultural change will be seen in time. The work force indicates in this study that the leadership at the product divisions and headquarters has done little to help obtain better quality. The work force will be looking for the deeds, such as the resources, training, and the right decisions, coming from Headquarters AFSC.

APPENDIX A

Contractor Quality Performance Evaluation Summary

A suggested format, included as Attachment 1 to this Appendix, is designed to provide a uniform format for assessing the contractor's performance and to provide data that can be used to fulfill the requirements of policy guidance that requires evaluation and utilization of contractor performance data. The recommended evaluation summary is divided into three categories: Quality of Quality Management Systems, Quality of Product Conformance and Quality of Design. The assessments are, to a significant degree, judgmental. The absolute data that is included will assist in providing a rationale for the assessments. That data will also, if collected over a period of time, and over a range of products, provide a basis of "normal" data which can be used to successfully evaluate and efficiently administer a particular contract.

In order to assure a thorough understanding of the evaluation process, the evaluator must prepare a written description or rationale of the factors that caused the assignment of the rating which is then multiplied by a value factor to arrive at an effectiveness rating. It is not possible to provide standard rationale in the format due to the diversity in products and contracts. Accordingly, each evaluator should discuss the attached proposed procedure with supervisory personnel. The rationale must take into account the type of equipment contracted for, e.g., systems/subsystems/components, etc.

The summary should be prepared on each contract over $500,000 at the end of the contract, or annually, if an extended period is involved as in a system contract. The summary should be discussed with the contractor and a copy retained in the plant for future contracting/precontracting activities. A copy will also be provided to the contracting officer and to the USAFCMD.

The individual score for each element/characteristic should be assigned a value in accordance with Table 1:

Table 1

Quality Valuation Ratings

Excellent	91	–	100
Very Good	81	–	90
Good	71	–	80
Marginal	61	–	70
Submarginal	0	–	61

ATTACHMENT 1

RECOMMENDED CONTRACTOR QUALITY

PERFORMANCE EVALUATION SUMMARY

Date _____

Contractor _____

Contract Number _____

Contract Date _____

Value _____

Number of Items _____

Evaluator _____

The objective of the evaluation is to provide a continuing assessment of the firm's quality program. The data below provides a standard rationale for selected parts of the program. The assessment is limited to these key parts to minimize and standardize the evaluation. The evaluator must assign a rating from table 1 which reflects an assessment of these activities.

Category 1, Quality of Quality Management Systems Factor = .6

	Element	Criteria	Rating	Factor	Effectiveness
A.	Quality Program Management	MIL-Q-9858, Para. 3.2	_____	x .2 =	_____%
B.	Production Processing and Fabrication	MIL-Q-9858, Para. 6.2	_____	x .2 =	_____%
C.	Measuring and Testing Equipment	MIL-Q-9858, Para. 4.2	_____	x .2 =	_____%
	Total Quality Management System Score				_____%

Category effectiveness is found by multiplying the rating times the factor (.2).

Rating _____ x .2 = _____%

Category 2, Quality of Product Conformance Factor = .2

The objective of this evaluation is to provide a continuing assessment of the conformance of products to design requirements. The data below will assist the evaluator in making what is primarily a subjective assessment. It will provide one uniform element of the analysis and will provide a continuing evaluation of product

conformance. The evaluator must assign a score from Table 1 which reflects an overall assessment of product conformance to requirements.

A. Acceptance Testing Results
   (1) _____ units completed acceptance test with no defects.
   (2) _____ units required retest due to defects.

B. Manufacturing Effectiveness
   (1) _____ major non-conformances were accepted.
   (2) _____ minor non-conformances were accepted.

Category effectiveness is found by multiplying the rating times the factor (.2).

Rating _____ x .2 = _____%

Category 3, Quality of Design Factor = .2

The objective of the evaluation is to provide a continuing assessment of the contractor's quality of design. The data below will assist the evaluator in making what is primarily a subjective assessment. It will provide one uniform element of the analysis and will provide a continuing evaluation of quality of design. The evaluator must assign a score from Table 1 which reflects an overall assessment of design quality.

Engineering Changes

(1) _____ Number of Class 1 changes accepted.

(2) _____ Number of Class 2 changes accepted.

(3) _____ Number of Class 1 changes that reduced system requirements.

(4) _____ Number of Class 1 changes submitted requiring further changes to parameters/characteristics revised in earlier approved changes.

Category effectiveness is found by multiplying the rating times the factor (.2).

Rating _____ x .2 = _____%

OVERALL QUALITY PERFORMANCE EVALUATION SCORE

Overall contractor score is found by summing Category 1 score, plus Category 2 score, plus Category 3 score.

Overall contractor quality rating = Category 1 score ____%
Category 2 score ____%
Category 3 score ____%
Total ____%

APPENDIX B

Quality Award Fee Approach

The CPAF contract is described in the DAR 3-405.5 and should be reviewed prior to development of an Award Fee scheme for a contract. In the event that a decision has been made to include an Award Fee feature, it is essential that the Award Fee approach be defined in the RFP stage. The RFP should include an explanation of the Award Fee features and the fee determining procedures that will be employed. The RFP must also identify the criteria that will be used to evaluate the responsiveness of proposals to the Award Fee requirements. The Award Fee Determination Plan (AFDP)* should be included as a separate entity with the RFP package. Considerations should be given to allowing prospective contractors to provide recommendations for possible improvements to the plan as a draft RFP.

When a contract is issued containing an Award Fee clause for quality, it is advantageous to provide limited references to the Award Fee in the contract itself and to retain the AFDP as a separate element. This will allow the flexibility of modifying the AFDP without modifying the basic contract and will simplify the administrative processes. The contract, however, should provide some coverage regarding the Award Fee aspect of the contract including the following:

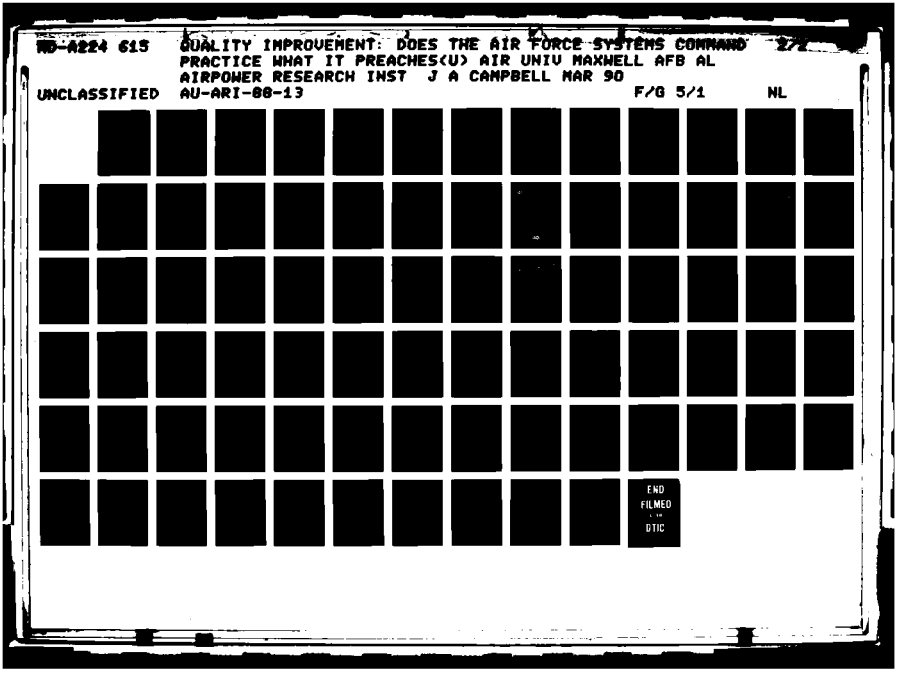
1. The Base Fee amount (can be zero but should be substantial, and may be influenced by other Award Fee aspects of the contract).
2. The Maximum Award Fee which can be earned.
3. The time intervals of evaluation and pay schedule and proportion which can be paid in each interval.
4. A provision that fee amounts will be determined unilaterally by the Fee Determination Official (FDO).
5. A provision that FDO determinations concerning Award Fee earned is binding on both parties and not subject to appeal under the dispute clause.
6. A provision for prompt payment of fee earned after each determination without a need for contract modification.
7. A provision allowing equitable adjustment of fee in the event of change orders or other contract modifications.
8. A provision that in the event of contract cancellation of FDO determination relative to the amount of Award Fee available will be final and not subject to the disputes clause.

The contract should also identify the AFDP by date and title and include a provision that the FDO has a unilateral right to change AFDP coverage. However, it should establish that the contractor will receive notice of changes by some specified number of days prior to the evaluation period in which the changes will be applied.

*Abbreviations shown in Exhibit G, page 105.

The amount of fee that can be awarded has a basic limitation in DAR 3-405.6(c)(2). However, the exact amount of the fee must be assessed in light of any other incentive fees that may be a part of the contract. Under ordinary circumstances, the total fee allowed for a contract for Research and Development is limited to 15 percent of the estimated cost or 10 percent in the case of a CPFF contract.

The Fee Determination Official and board members must be chosen with consideration of their availability to devote adequate time to the plan as well as their position in the government hierarchy. It is desirable to have representatives from organizations outside of the plant when the plan is employed. In particular, representation from the using command is highly desirable. In the attached format, in some cases, personnel are identified by title. This is only for illustrative purposes. The evaluation intervals are also examples. Attachment 1 is a format which may be used as an Award Fee plan.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QUALITY IMPROVEMENT: DOES THE AIR FORCE SYSTEMS COMMAND
PRACTICE WHAT IT PREACHES(U) AIR UNIV MAXWELL AFB AL
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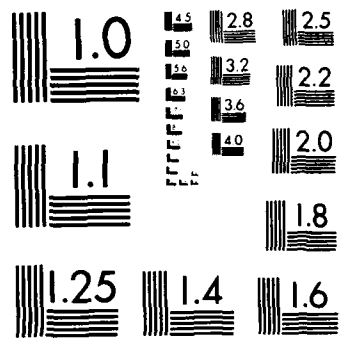

ATTACHMENT 1

SAMPLE AWARD FEE FORMAT AND APPROACH

AWARD FEE DETERMINATION PLAN FOR

Contract No. _____ with _____ (firm) _____

Contents

APPROVED BY:

_____ (signature) _____ (date) _____

_____ (typed name) _____

_____ (title) _____

1. GENERAL TERMS AND CONDITIONS

A. This plan describes the method of administration of the Award Fee provisions of contract no. _____, dated _____, with _____.

B. The term of the contract is from _____through _____.

1. The estimated cost of performing the contract is $_____.
2. The base fee is $_____.
3. The maximum Award Fee is $_____.
4. The estimated cost, base fee, and Award Fee are subject to equitable adjustments on account of changes or other contract modifications.
5. The Award Fee earned and payable will be determined periodically by the Fee Determination Official in accordance with this plan.
6. Award Fee findings and decisions are not subject to the Disputes clause of the contract.
7. The FDO* may unilaterally change the matters in this plan, as covered in part 5 and not otherwise requiring mutual agreement under the contract, providing the contractor receives notice of the changes at least _____ work (or calendar) days prior to the beginning of the evaluation period to which the changes apply.

C. The objective of the Award Fee provisions of the contract is to afford the contractor an opportunity to earn increased fee commensurate with the achievements of optimum performance in pursuit of contract objectives and goals.

2. MANAGEMENT AND ADMINISTRATION OF THE AWARD FEE PROGRAM

The following management procedure is established for administering the Award Fee provisions of the contract.

A. Fee Determination Official (FDO)

(1) The FDO is Deputy Director SPO

(2) Primary FDO responsibilities are:

(a) determining the Award Fee earned and payable for each evaluation period as addressed in Part 4.

(b) changing the matters covered in this plan as addressed in Part 5, as appropriate.

B. Performance Evaluation Board (PEB)

(1) The Chairman of the PEB is Director of Engineering SPO

The following are voting members:

Using Command Representative _____

*All abbreviations are contained in Exhibit G.

Director of Contracting SPO _____

Director of Quality Assurance SPO _____

Chief of Quality Assurance AFPRO _____

Other _____

(2) The Chairman may recommend the appointment of non-voting members to assist the Board in performing its functions.

(3) Primary responsibilities of the Board are:

(a) Evaluate the contractor's performance in accordance with the performance criteria set forth in the contract (and/or in this plan). Evaluation methods will include but not be limited to:

- performance monitor reports
- other reports which provide useful data

(b) Prepare a Performance Evaluation Board Report for the FDO, including the Board's findings and recommendations for each evaluation period as addressed in Part 4.

(c) Periodically review the evaluation plan and its implementation, and recommend necessary changes in accordance with Part 5.

C. Performance Monitors (PMs)

(1) The PEB Chairman will assign a PM to each performance area to be evaluated.

(2) Each PM will be responsible for complying with the *General Instructions* for Performance Monitors in Exhibit B, and any specific instructions of the PEB Chairman including the following primary responsibilities:

- Monitoring, evaluating, and assessing contractor performance in assigned activities.
- Periodically preparing a Performance Monitor Report (PMR) for the PEB.
- Recommending appropriate changes in this plan for consideration in accordance with Part 5.

3. EVALUATION FACTORS

Evaluation requirements are attached as follows:

	Requirements	Attachment
A.	Evaluation Periods and Maximum Available Award Fee for Each	Exhibit A
B.	Performance Factors and Evaluation Criteria Exhibit B	
C.	Scoring Table	Exhibit C
D.	Award Fee Conversion Chart	Exhibit D

The percentages described in Exhibit B, the scoring table in Exhibit C, and the conversion chart in Exhibit D are provided as a typical methodology for a general assessment of the proportion of the available Award Fee that has been earned. They provide only sample guidance and a judgmental evaluation of contractor performance and should not be considered to be the results of a rigorous mathematical determination.

4. AWARD FEE DETERMINATION METHODOLOGY

A determination of the Award Fee earned for each evaluation period will be made promptly by the FDO after the end of the period. The method to be followed in monitoring, evaluating and assessing contractor performance during the period, as well as for determining the Award Fee earned, is described below. Exhibit E-1 summarizes the principal activities and recommended schedules.

A. The PEB Chairman will assign a PM for each performance area to be evaluated under the contract. PMs will be selected on the basis of their expertise relative to prescribed areas of performance. The PEB Chairman may change PM assignments at any time without advance notice to the contractor but should notify the contractor as promptly as possible.

B. The PEB Chairman will provide to each PM the following documents:

   (1) A copy of the pertinent elements of the contract and subsequent modifications.

   (2) A copy of this plan along with any changes made.

   (3) Sufficient instructions to perform the PM responsibilities.

   (4) Any unique instructions concerning PM-assigned performance areas.

C. PMs will monitor, evaluate and assess contractor performance and discuss the results with appropriate contractor personnel, in accordance with the General Instructions for Performance Monitors (Exhibit E-2), and any other specific instructions or guidance furnished by the PEB Chairman.

D. PMs will submit monthly PMRs and, if required, make verbal presentations to the PEB.

E. The PEB Chairman will consider PMRs and request and obtain performance information from other units or personnel that may assist in determining contractor performance. He will discuss reports and information with PMRs and other personnel as he deems necessary.

F. Promptly after the end of each month, except the final month of the evaluation period, the PEB Chairman will meet with the contractor and discuss overall performance during the period. If requested by the PEB Chairman, PMs and other personnel involved in performance evaluations will attend the meeting and participate in discussions.

G. Promptly after the end of each evaluation period, the PEB will meet and consider all performance information obtained, summarize preliminary findings, and determine recommendations for coverage in the PEBR.

H. Subsequently, the PEB Chairman will meet with the contractor Award Fee representative and discuss preliminary findings and recommendations. As requested by the PEB Chairman, PMs and other personnel involved in performance evaluation will attend the meetings and participate in discussions. At this meeting, the contractor representative will be given an opportunity to submit matters in the firm's behalf, including an assessment of performance during the evaluation period.

I. After meeting with contractor personnel, the PEB will consider matters presented by contractor personnel and establish Board findings and recommendations for the PEBR.

J. The PEB Chairman will prepare the report for the period and submit it to the FDO for use in determining the Award Fee earned. The report will include a recommended range of Award Fee with supporting documentation. When submitting the report, the Chairman will inform the FDO whether or not the contractor's representative desires to present any matters to the FDO before the Award Fee determination is made.

K. The FDO will review the PEBR and discuss it with the PEB Chairman and other personnel, as appropriate. If requested by the contractor, or if the FDO considers it appropriate, the FDO will meet with the contractor for discussions. If requested by the FDO, the PEB Chairman and any other personnel involved in performance evaluation may be required to attend the meeting with the contractor.

L. The FDO will determine the amount of Award Fee earned during the period. The amount determined will include the results of judgmental assessments as well as utilizing the analytical procedures herein. The FDO's determination of the amount of Award Fee earned and the basis of this determination will be stated in the Award Fee Determination Report (AFDR). The report will be signed by the FDO and provided to the contractor as justification for payment of the Award Fee granted.

5. CHANGES

A. Unilateral Changes

The FDO may unilaterally change any matters covered in this plan not otherwise requiring mutual agreement under the contract, prior to the beginning of any evaluation period by timely notice to the contractor in writing. The changes will be made without formal modification of the contract.

B. Method For Making Changes

The method to be followed for changing plan coverage follows. Exhibit F summarizes the principal actions and schedules involved.

(1) Any person involved in the administration of the Award Fee provisions of the contract may recommend any changes in the plan which will result in improved performance or improve the Award Fee determination

process by providing the recommended changes to the PEB for his evaluation.

(2) Any proposed changes will be coordinated with the contractor by the PEB Chairman.

(3) Prior to the end of each evaluation period, the PEB will submit changes applicable to the next evaluation period for approval by the FDO with appropriate comments and justification, or inform the FDO that no changes are recommended for the next period.

(4) ___*___ work days before the beginning of each evaluation period, the FDO will notify the contractor in writing if any changes will be made. If any such notification is not provided to the contractor within the agreed-to number of work days before the beginning of the next period, existing plan coverage will continue in effect for the next evaluation period.

*Number of days are to be agreed upon by both parties during contract negotiations.

EXHIBIT A TO AFDP FOR CONTRACT # _____

Contract No. _____ with _____

EVALUATION PERIODS AND MAXIMUM
AVAILABLE AWARD FEE FOR EACH

Evaluation Period

No.	Duration*	Ending	Max. Available Award Fee
1	3 months		
2	6 months		
3	6 months		
4	6 months		
5	6 month intervals to end of contract		

Maximum Fee Each Evaluation Period = $\frac{\text{Total Fee}}{\text{Number of evaluation periods}}$

*Periods and equal fee distributions here are examples only. If the fee is varied for different periods, the evaluation equation must be modified.

EXHIBIT B TO AFDP FOR CONTRACT # _____

PERFORMANCE FACTORS AND EVALUATION CRITERIA

The performance areas to be evaluated are identified below.
The evaluation criteria for each area are attached, as indicated.

Area No.	Factor Identification	Factor Weight	See Exhibit
1	Quality System Management	.25	B-1
2	Production of Nonconforming Material	.25	B-2
3	Major Assembly Inspection Findings	.25	B-3
4	Completed End Item Quality Assessment	.25	B-4

EXHIBIT B-1 TO AFDP FOR CONTRACT # _____

EVALUATION CRITERIA FOR PERFORMANCE FACTOR NO. 1

QUALITY SYSTEM MANAGEMENT — Factor Weight .25

Description of Element:

Para. 3 MIL-Q-9858A

The objective of the element is to encourage corporate wide involvement in the quality management system.

Sub-Elements to Consider:

Para. 3.1 Organization, 3.4 Records, 3.5 Corrective Action, 3.6 Costs related to quality.

Evaluation Criteria:

Evaluation will be per MIL Handbook H50, Para. 3.1, 3.4, 3.5, and 3.6 except that complete cost data should be available for prevention, appraisal, and failure (both internal and external costs).

Basis or Standard for Measuring Performance:

This is a subjective appraisal of a firm's performance as evaluated by the PM. It is to be used in consonance with the narrative instruction in the rating table (Exhibit C).

Sub-Element Weights:

3.1 - .3	Para. 3.1	Score _____ x .3 = _____
3.4 - .2	Para. 3.4	Score _____ x .2 = _____
3.5 - .3	Para. 3.5	Score _____ x .3 = _____
3.6 - .3	Para. 3.6	Score _____ x .2 = _____
		Total _____

EXHIBIT B-2 TO ADFP FOR CONTRACT # _____

EVALUATION CRITERIA FOR PERFORMANCE FACTOR NO. 2

NON-CONFORMING MATERIAL — Factor Weight .25

Description of Element:

The objective of this factor is to develop a manufacturing process in which the production of defective material is the consequence of only random events.

Sub-Element to Consider:

(1) Purchased material, (2) machine/process functions, (3) assembly, (4) productivity

Evaluation Criteria:

1. Is there an approved overall company cost factor for manufacturing losses resulting from costs associated with the procurement of defective material?

2. Are man/machine process capability studies performed to analyze production problems?

3. Are process control records maintained at assembly stations that identify recurring defects?

4. Is there a positive program to publicize improvements in productivity resulting from quality improvements?

Basis or Standard for Measuring Performance:

This is a subjective appraisal of the firm's performance as evaluated by the PM. It is to be used in consonance with the narrative instructions in the rating table (Exhibit C).

Sub-Element Weights:

1. – .25 Score _____ x .25 = _____
2. – .25 Score _____ x .25 = _____
3. – .25 Score _____ x .25 = _____
4. – .25 Score _____ x .25 = _____

Total _____

EXHIBIT B-3 TO AFDP FOR CONTRACT # _____

EVALUATION CRITERIA FOR PERFORMANCE FACTOR NO. 3

MAJOR ASSEMBLY INSPECTION Factor Weight .25

Description of Element:

The objective of this element is to assure the development of a system to analyze and eliminate non-random manufacturing/assembly/test problems that contribute to end item testing problems, delays and costs.

Sub-Elements to Consider:

All areas where subsystems or major components are given a final checkout prior to assembly into the final item/system configuration. In the interests of focusing attention sub-elements should not exceed 10.

Evaluation Criteria:

The criteria should concentrate on:

1. identification of significant problems
2. analysis as to their cause
3. promptness and effectiveness of corrective action taken

Basis for Measuring Performance:

This is a subjective appraisal of the firm's performance as evaluated by the PM. It is to be used in consonance with the narrative instructions in the rating table (Exhibit C).

Sub-Element Weights:

The evaluation must determine how many sub-elements, (subsystem checkout stations) there are. It is recommended that an equal weight be assigned to each and that a table and scoring procedure similar to that in Exhibit B-1 be prepared, e.g. - *

Sub-Element 1 - .33 Score _____ x .33 = _____
Sub-Element 2 - .33 Score _____ x .33 = _____
Sub-Element 3 - .33 Score _____ x .33 = _____

Total _____

*The number of elements is immaterial but the total score cannot exceed 1.0.

EXHIBIT B-4 TO AFDP FOR CONTRACT # _____

EVALUATION CRITERIA FOR PERFORMANCE FACTOR NO. 4

COMPLETED END ITEM QUALITY ASSESSMENT Factor Weight .25

Description of Element:

The objective of this element is to generate a measure of product quality in terms of conformance with design requirement. It provides product conformance information both in the manufacturer's facility and after delivery.

Sub-Elements to Consider:

1. Number of defects found by contractor in final end item inspection/test on each end item.
2. Number of minor waivers granted on each end item.
3. Number of major waivers granted on each end item.
4. Number of defects found by user if inspection is performed.
5. Number of user generated deficiency reports.

Evaluation Criteria:

In-plant final inspection

User inspection activities

User routine deficiency reports

Basis or Standard for Measuring Performance:

This is a subjective appraisal of the firm's performance as evaluated by the PM. It is to be used in consonance with the narrative instructions in the rating table (Exhibit C).

Sub-Element Weights:

1 – .2	Sub-Element 1	Score _____ x .2 =	_____
2 – .1	Sub-Element 2	Score _____ x .1 =	_____
3 – .3	Sub-Element 3	Score _____ x .3 =	_____
4 – .3	Sub-Element 4	Score _____ x .3 =	_____
5 – .1	Sub-Element 5	Score _____ x .1 =	_____
		Total	_____

EXHIBIT C TO AFDP FOR CONTRACT # _____

RATING TABLE

Narrative Grade	Description	Proportion of Maximum Achievable Score Available
Excellent	Performance far exceeds that normally achieved for a similar task. Few errors are made. Management and employee controls outstanding.	90 – 100
Good	Performance exceeds that normally achieved. Above average achievement of all areas of element.	60 – 90
Satisfactory	Performance meet minimum standards. No exceptional management emphasis on quality, problems encountered, routinely resolved.	30 – 50
Marginal	Performance less than expected. Continuing extraordinary efforts required to assure material is meeting requirements.	10 – 20
Unsatisfactory	Performance not acceptable. Material cannot be shipped without government inspection. Quality management system not accepted.	0

EXHIBIT D TO AFDP FOR CONTRACT # _____

The following table converts achieved Award Fee scores into fee earned.

Performance Scores:

Factor No. 1, Score ___ x .25 = Available % of Award Fee ___

Factor No. 2, Score ___ x .25 = Available % of Award Fee ___

Factor No. 3, Score ___ x .25 = Available % of Award Fee ___

Factor No. 4, Score ___ x .25 = Available % of Award Fee ___

Total % available Award Fee earned ___

Total % of Award Fee earned ____ x available fee____= ____ fee earned.

EXHIBIT E-1 TO AFDP FOR CONTRACT # _____

The following is a summary of the principal actions involved in determining the Award Fee for each evaluation period.

Action	Schedule (Work Days)
PED Chairman appoints PMs, provides necessary guidance, and informs contractor	as required
PMs assess performance and discuss results with contractor	throughout the period
PMs submit PMRs to PEB	last day of each month
PEB obtains performance information from other procuring activity personnel	as necessary
PEB considers PMRs and any other available performance information	continuing
PEB Chairman discusses overall performance with contractor during period	_____ days after end of each month, except last month in period
PEB meets and prepares preliminary findings and position for PEBR	_____ days after end of period
PEB Chairman meets with contractor and discusses preliminary findings and position	_____ days after end of period
PEB establishes findings and recommendations for PEBR	_____ days after end of period
PEB Chairman submits PEBR to FDO	_____ days after end of period
FDO reviews PEBR and discusses it with PEB, as appropriate	_____ days after end of period
FDO sends AFDR to contractor and contracting office	_____ days after end of period

The PEBD will establish appropriate lists of subsidiary actions and schedules to meet the above schedules, as necessary.

EXHIBIT E-2 TO AFDP FOR CONTRACT # _____

PERFORMANCE MONITORS INSTRUCTIONS

1. Monitoring and Assessing Performance

   a. PMs will prepare outlines of their assessment plans as a part of the PEB documentation. The plan should be discussed with appropriate contractor personnel to assure understanding of the evaluation and assessment methodology.

   b. PMs will plan and carry out both scheduled and unannounced assessment visits; however, before each scheduled visit, the PM should contact appropriate contractor personnel who may accompany the PM, if desired.

   c. PMs will conduct all assessments in an open, objective and cooperative spirit so that a fair and valid evaluation is achieved. This will enable contractor personnel to plan improvements in performance. Positive performance accomplishments must be recognized as well as inadequate results.

   d. After assessments, the PM will discuss the results with appropriate contractor personnel, noting any observed deficiencies and/or accompanying recommendations. Areas of poor performance will be discussed to afford the contractor an opportunity to clarify possible misunderstandings and to resolve deficiencies.

   e. PM contacts with contractor personnel are to be accomplished within the context of official contractual relationships. Any activity or association which might cause, or give the appearance of causing, a conflict of interest must be avoided.

   f. PM discussions with contractor personnel are not to be used to instruct or direct contractor personnel in the performance of a contract.

2. Documenting Evaluations/Assessments

   Evaluations and assessments conducted, results obtained, and discussions with contractor personnel will be documented immediately after each such actions by preparing a brief summary of observations and discussions with contractor personnel.

3. Evaluation/Assessment Reports

   PMs will prepare a normal PMR in accordance with the following instructions and submit it to the PEB, or others, if appropriate, at the end of each month. Information essential to the PMR element involved should be identified and a format specified if deemed advisable.

4. Verbal Reports

   PMs will be prepared to make verbal reports as required by the PEB Chairman.

5. Performance Monitor Report

   The PMR will contain, as a minimum, a record of each meeting or discussion in connection with the Award Fee reviews, including the names of contractor personnel, date of meeting(s), and a brief summary of discussions. Any differences of opinion with contractor personnel must be included with a full and complete discussion of the issues.

EXHIBIT F TO AFDP FOR CONTRACT # _____

CONTINGENCY PLAN FOR CHANGING PLAN COVERAGE

The following is a summary of the principal actions involved in changing plan coverage.

Action	Schedule (Work Days)
1. PEB drafts proposed changes	as necessary
2. PEB coordinates proposed changes with contractor	as necessary
3. PEB submits recommended changes to FDO	_____ days prior to end of each period
4. FDO notifies contractor of changes or that there are no changes	_____ days before start of applicable period

EXHIBIT G - LIST OF TERMS AND ABBREVIATIONS

The following is an alphabetical list of all acronyms used throughout Appendix VI-3:

AF	Award Fee
AFDP	Award Fee Determination Plan
AFDR	Award Fee Determination Report
CAFR	Contractor Award Fee Representative
CPAF	Cost-Plus Award Fee
FDO	Fee Determination Official
FM	Function Monitor
FMR	Function Monitor Report
FPI	Fixed-Price Incentive
ICC	Incentive Contracting Committee
PEB	Performance Evaluation Board
PEBC	Performance Evaluation Board Chairman
PEBR	Performance Evaluation Board Report
PEC	Performance Evaluation Committee
PECR	Performance Evaluation Committee Report
PM	Performance Monitor
PMR	Performance Monitor Report
RFP	Request For Proposal

APPENDIX C

LETTERS

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE SYSTEMS COMMAND
ANDREWS AIR FORCE BASE DC 20334-5000

REPLY TO ATTN OF PL

1 FEB 19

SUBJECT Research Questionnaire

TO Quality Improvement Survey Participant

1. As the Deputy Chief of Staff for Product Assurance and Acquisition Logistics at HQ AFSC, I want to ensure that we are doing what we should to acquire the highest quality weapon systems in the most effective manner possible. That is why the AFSC Research Fellow at the Air Command and Staff College has developed this survey. You have been selected to receive this questionnaire because of your position and experience in the acquisition community. I encourage you to take the time to fully complete the survey based on your present knowledge and abilities.

2. The purpose of this research is to see what can and should be done to improve the level of quality in our weapon systems by assessing the practices we currently use. We will be surveying program directors, program managers, project managers and quality assurance managers in AFSC's product divisions. Your response will remain anonymous. Please do not put your name or social security number on the answer sheet. When you have completed the questionnaire, return it in the enclosed postage paid envelope with any comments you wish to provide. Please respond no later than 29 Feb 88.

3. I sincerely appreciate your participation in this important research effort. If you would like any feedback on the results of this survey, you may contact my project officer, Maj John Campbell, AUTOVON 875-2207.

DAVID J. TEAL, Maj Gen, USAF
DCS/Product Assurance and
Acquisition Logistics

UNITED STATES AIR FORCE
SEPTEMBER 18, 1947

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
CENTER FOR AEROSPACE DOCTRINE, RESEARCH, AND EDUCATION
MAXWELL AIR FORCE BASE, AL 36112-5532

REPLY TO ATTN OF RIC

3 MAR 1988

SUBJECT Quality Improvement Research Questionnaire

TO Program Director

1. A few weeks ago I sent you letter from Major General David Teal, DCS/Product Assurance and Acquisition Logistics, HQ/AFSC. His letter requested you to fill out a questionnaire on quality improvement research that I am doing for HQ AFSC. If you have already returned the questionnaire, please disregard this letter. However, if you have not done so, please let me encourage you to do so as soon as possible. It is important for the validity of this research that I receive your response no later than 18 March 1988. If you have lost the questionnaire or did not receive one please call me at AUTOVON 875-2207 and I will immediately mail you one.

2. I realize that you are very busy and that I am imposing an additional burden upon you, but I think your comments are important and with them we might improve how we manage quality in the future. Thank you in advance for your time and effort.

JOHN A. CAMPBELL, Major, USAF
HQ AFSC Research Fellow

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
CENTER FOR AEROSPACE DOCTRINE, RESEARCH, AND EDUCATION
MAXWELL AIR FORCE BASE, AL 36112-5532

3 MAR 1988

REPLY TO ATTN OF: RIC

SUBJECT: Quality Improvement Research Questionnaire

TO: AFSC Quality Assurance Managers

1. A few weeks ago I sent you letter from Major General David Teal, DCS/Product Assurance and Acquisition Logistics, HQ/AFSC. His letter requested you to fill out a questionnaire on quality improvement research that I am doing for HQ AFSC. If you have already returned the questionnaire, please disregard this letter. However, if you have not done so, please let me encourage you to do so as soon as possible. It is important for the validity of this research that I receive your response no later than 18 March 1988. If you have lost the questionnaire or did not receive one please call me at AUTOVON 875-2207 and I will immediately mail you one.

2. I realize that you are very busy and that I am imposing an additional burden upon you, but I think your comments are important and with them we might improve how we manage quality in the future. Thank you in advance for your time and effort.

JOHN A. CAMPBELL, Major, USAF
HQ AFSC Research Fellow

APPENDIX D

PROGRAM DIRECTOR AND MANAGER QUESTIONNAIRE

RESEARCH QUESTIONNAIRE

MAJ JOHN A. CAMPBELL

Airpower Research Institute

Maxwell Air Force Base AL
36112

Survey Control Number USAF SCN 87 – 130B

INSTRUCTIONS

1. Thank you for taking the time to fill out this questionnaire. Most of the answers will require you to respond on a five point scale. Since there are no "right" or "wrong" answers and many questions ask for your opinion, please mark the answer that most closely represents your position.

2. You can use this booklet to mark your answers and then transfer them to the answer sheet provided. Please use a black, soft lead pencil (No. 2) on the answer sheet. When you are done please return the answer sheet in the enclosed addressed envelope. If you would like to provide additional information, either enclose an additional sheet of paper with your comments or make your comments on the questionaire.

3. Please try to answer each question, however **if no answer applies or you do not have the knowledge to answer it, then skip it** and go to the next question.

4. Your name or organization is not needed for this study. However, if you would like to receive a brief summary of the results of this study, please provide your name and address. You or your organization will not in any way be identified in this study.

5. Thank you for your time and cooperation.

JOHN A. CAMPBELL, Maj, USAF
HQ AFSC Research Fellow
Airpower Research Institute

WORK FORCE PROFILE

	GS/M MIL	16 B/G	15 Col	14 LTC	13 ≤ 12 MAJ ≤ CPT
1. What is your military/civilian equivalent rank?		a	b	c	d e
2. How many **years** have you worked in a program management function?	≥ 10	9-8	7-6	5-4	≤ 3
		a	b	c	d e
3. How many different systems/items have you managed?	≥ 5	4	3	2	1
		a	b	c	d e
4. How many **years** have you worked on this program (your current one)?	≥ 5	4	3	2	1
		a	b	c	d e
5. Are you **the** program director/program manager versus a project manager on a system/subsystem?		YES	NO		
		a	b		
6. Your system/item is primarily in which acquisition phase?		Concep	Val	FSD	Prod Deploy
		a	b	c	d e
7. How many **full-time** quality personnel are assigned to your organization?	≥ 4	3	2	1	0
		a	b	c	d e
8. How much of your day **(hours)** is spent on quality issues (failures/corrections)?	≥ 5	4-3	2	1	0
		a	b	c	d e
9. How many **weeks** of AF training in program management have you had?	≥ 10	9-8	7-6	5-4	≤ 3
		a	b	c	d e
10. How many **hours** of training/education have you had specifically addressing how to improve quality hardware/services?	≥ 40	39-30	29-20	19-10	≤ 9
		a	b	c	d e
11. How many courses to improve product performance and durability have you attended within the last 2-3 years?	≥ 4	3	2	1	0
		a	b	c	d e

==========

SYSTEM PROGRAM QUALITY

Use the scale at right to answer questions 12-15.

	Daily	Weekly	Monthly	Qtrly	Never
12. How often do **you** interface directly with the SPO personnel who track quality performance?	a	b	c	d	e
13. How often do **you** personally review user complaint data/trends on your system/item?	a	b	c	d	e

	Daily	Weekly	Monthly	Qtrly	Never
14. How often do **you** personally review your contractor's rework, repair, retest scrap, etc., levels?	a	b	c	d	e
15. How often do **you** personally review your contractor's "cost of quality" (failure costs + routine inspection + prevention costs) data/trends?	a	b	c	d	e

16. How many quality of **conformance** problems have had **significant** program impacts during the past year (i.e., schedule, cost, accident, publicity, etc.)?	>10 a	5 b	3 c	1 d	0 e
17. As a percentage of total contract value, what would **you** estimate the "cost of quality" is for your program?	≥ 25% a	24-20% b	19-15% c	14-10% d	≤ 9% e

Use the scale at right to answer questions 18-20. These questions are asking you to rate the breakdown of the cost of quality. If you don't know, leave it blank.

	≥ 90%	89-70%	69-50%	49-30%	≤ 29%
18. What percentage does **failure** cost contribute to your cost of quality?	a	b	c	d	e
19. What percentage does routine factory **inspection** contribute to your cost of quality?	a	b	c	d	e
20. What percentage does **prevention** measures contribute to your cost of quality?	a	b	c	d	e
21. What degree of confidence do you have in the accuracy for your cost of quality estimate?	≥ 95% a	94-75% b	74-50% c	49-25% d	≤ 25% e

The next group of questions will help us determine from your perspective how best to improve quality assurance management. Each question is asking to what extent you think the statement applies to you/your organization. Therefore, each question should be preceded by **TO WHAT EXTENT. If you don't know the answer, leave it blank.**

Use the scale at right to answer questions 22-70.

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
22. Does your user influence contractor quality of hardware/services?	a	b	c	d	e

TO WHAT EXTENT	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
23. Have delivery schedules taken priority over quality decisions?	a	b	c	d	e
24. Do engineering errors lead to problems in managing your system/item?	a	b	c	d	e
25. Do manufacturing errors lead to problems in managing your system/item?	a	b	c	d	e
26. Do quality assurance personnel help you achieve the expected level of quality?	a	b	c	d	e
27. Are you able to influence the contractor to provide quality products using contract requirements?	a	b	c	d	e
28. Are you able to influence the contractor to provide quality products using good business practices?	a	b	c	d	e
29. Would a **Firm Fixed Price** type contract influence your contractor to provide a quality product?	a	b	c	d	e
30. Would an **award fee** influence your contractor to provide a quality product?	a	b	c	d	e
31. Would a **warranty** influence your contractor to provide a quality product?	a	b	c	d	e
32. Has your **contractor** used employee motivation techniques to improve quality of products?	a	b	c	d	e
33. Has your contractor's top management's attention influenced the quality of the product for your user?	a	b	c	d	e
34. Do your quality personnel focus on defect prevention rather than detection?	a	b	c	d	e
35. Do you think the number of quality problems in the last year were normal for a program of your complexity?	a	b	c	d	e
36. Are the right kind of quality assurance personnel assigned to your program?	a	b	c	d	e

TO WHAT EXTENT	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
37. Has your **prime** contractor instituted an active quality **improvement** program based upon continuous evaluation?	a	b	c	d	e
38. Does your prime contractor conduct **subcontract** quality **improvement** programs?	a	b	c	d	e

TO WHAT EXTENT **Questions 39-42:** Have **design/manufacturing** problems impacted the following on your system:	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
39. Schedule?	a	b	c	d	e
40. System/item cost?	a	b	c	d	e
41. Performance?	a	b	c	d	e
42. Reliability?	a	b	c	d	e

TO WHAT EXTENT					
43. Are **"measurable"** quality improvement goals defined by your organization?	a	b	c	d	e
44. Is your **contractor's** performance measured against quality standards that you both agree upon?	a	b	c	d	e
45. Does your organization expend sufficient resources to improve quality?	a	b	c	d	e
46. Is producing a quality product for your user the **most** important organizational objective?	a	b	c	d	e
47. Does your contractor share your quality objectives?	a	b	c	d	e
48. Do you think you have the right number of quality assurance personnel assigned to your program?	a	b	c	d	e
49. Has the **staff** quality organization aided in helping raise the level of quality in your system/item?	a	b	c	d	e

TO WHAT EXTENT	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
50. Has HQ AFSC leadership contributed to raising the level of quality in your system/item?	a	b	c	d	e

Questions 51-55:
To what extent are <u>you</u> using the following measures and/or indicators of quality?

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
51. Comparison of planned versus actual man-hours data.	a	b	c	d	e
52. A development process that designs quality into the product.	a	b	c	d	e
53. Monitoring defects and workmanship data.	a	b	c	d	e
54. Field performance data.	a	b	c	d	e
55. Subcontractor yield rates.	a	b	c	d	e

Questions 56-60:
To what extent does your <u>contractor</u> use the following measures and/or indicators of quality?

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
56. Product return rate (cost to rework).	a	b	c	d	e
57. Degrees of manufacturing process standardization.	a	b	c	d	e
58. Production yield rates.	a	b	c	d	e
59. Accept/reject rate at work centers.	a	b	c	d	e
60. Material review board/quality deficiency reports (MRB/QDR) action effectiveness (repeats).	a	b	c	d	e

Questions 61-65:
To what extent does your <u>SPO</u> use the following approaches to achieve better quality?

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
61. Team building between SPO, CAS, and contractor.	a	b	c	d	e

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
62. Producibility risk reduction efforts funded well before production.	a	b	c	d	e
63. Hardware quality audits.	a	b	c	d	e
64. Educational programs aimed at excellence in management and technical fields.	a	b	c	d	e
65. Monitor performance to goals.	a	b	c	d	e

==========

Questions 66-70: To what extent are the following approaches to achieve better quality being used by your <u>contractor</u>?	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
66. Total quality management approach.	a	b	c	d	e
67. Quality improvement through design teams.	a	b	c	d	e
68. Statistical process control including vendors.	a	b	c	d	e
69. Preferred vendor program with ratings on quality and schedule.	a	b	c	d	e
70. Emphasis on supplier's quality.	a	b	c	d	e

==========

From the following list of 10 items pick the **three** most important contributors in improving quality and productivity and rank them. Mark question 153 as the **most** important contributor, 154 as the next most important contributor, and 155 as the third most important contributor. For example, if you think program stability (item h) is most important then you would mark question 153h, the next item would go in question 154, etc.

a. Better job of stating and controlling requirements.
b. Contractor using transition templates to do real risk management.
c. Top-down corporate training to cultivate awareness of QA impact to life cycle costs.
d. Commitment to not accepting poor quality.
e. Past performance rating in source selection on quality.
f. Require all discrepancies be referred to standards.
g. Positive re-enforcement programs (incentives).
h. Program stability (funding/requirements/design).
i. Early producibility/manufacturing/quality input to design.
j. Disallow all costs for scrap and rework costs in pricing items.

****

From the following list of **10** items pick the **three** most important items that **detracts** from achieving quality and productivity and rank them. Mark question **156** as the **most** important detractor **157** as the next most important detractor and **158** as the third most important detractor.

a. Unrealistic program schedules.
b. Nebulous definition of quality assurance.
c. Lack of cooperation among personnel (i.e., design, quality, test, manufacturing, etc.).
d. Old line quality approaches (i.e., inspection quality).
e. Complexity of DoD organization which limits flexibility and response time.
f. Priority of quality within AF program objectives.
g. Program instability.
h. Reassigment of key program personnel.
i. Poor vendor/subcontractor quality levels.
j. Inadequate investment up front.

THANK YOU AGAIN FOR YOUR PARTICIPATION!

COMMENTS?

APPENDIX E

QUALITY ASSURANCE PERSONNEL QUESTIONNAIRE

RESEARCH QUESTIONNAIRE

MAJ JOHN A. CAMPBELL

Airpower Research Institute

Maxwell Air Force Base AL
36112

Survey Control Number USAF SCN 87 – 130A

INSTRUCTIONS

1. Thank you for taking the time to fill out this questionnaire. Most of the answers will require you to respond on a five point scale. Since there are no "right" or "wrong" answers and many questions ask for your opinion, please mark the answer that most nearly represents your position.

2. You can use this booklet to mark your answers and then transfer them to the answer sheet provided. Please use a black, soft lead pencil (No. 2) on the answer sheet. When you are done please return the answer sheet in the enclosed addressed envelope. If you would like to provide additional information, either enclose an additional sheet of paper with your comments or make your comments on the questionaire.

3. Please try to answer each question, however **if no answer applies or you do not have the knowledge to answer it, then skip** it and go to the next question.

4. Your name or organization is not needed for this study. However, if you would like to receive a brief summary of the results of this study, please provide your name and address. You or your organization will not in any way be identified in this study.

5. Thank you for your time and cooperation.

JOHN A. CAMPBELL, Maj, USAF
HQ AFSC Research Fellow
Airpower Research Institute

WORK FORCE PROFILE

1.	What is your civilian rank?	≥ 14 a	13 b	12 c	11 d	≤ 09 e
2.	What is your military rank?	LTC a	MAJ b	CPT c	1LT d	2LT e
3.	How many **years** have you worked in quality assurance?	≥ 18 a	17-13 b	12-8 c	7-4 d	≤ 3 e
4.	How many different systems/items have you worked on?	≥ 5 a	4 b	3 c	2 d	1 e
5.	How many **years** have you worked on this program?	≥ 5 a	4 b	3 c	2 d	1 e
6.	Are you dedicated to a system/subsystem versus assigned to staff?	YES a	NO b			
7.	Your system/item is primarily in which acquistion phase?	Concep a	Val b	FSD c	Prod d	Deploy e
8.	How many full-time quality personnel are assigned to your organization?	≥ 4 a	3 b	2 c	1 d	0 e
9.	How many **weeks** of ... training in quality assurance have you had?	≥ 12 a	11-9 b	8-6 c	5-3 d	≤ 2 e
10.	How many courses that taught statistical quality/process control have you attended within the last 5 years?	≥4 a	3 b	2 c	1 d	0 e
11.	How many courses to improve product performance and durability have you attended within the last 2-3 years ?	≥ 4 a	3 b	2 c	1 d	0 e
12.	What is your highest level of education?	HS a	HS+ b	Bach c	Bach+ d	Master e
13.	What was your college major?	ENGR a	SCI b	BUS c	ARTS d	OTHER e
14.	Do you have adequate opportunities to attend formal training courses?	YES a	NO b			

Questions 15-24

Use the scale at right to answer questions 15-24. These questions will help us determine if the correct subject material is taught in our formal courses.

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
15. To what extent have formal courses helped you perform your job?	a	b	c	d	e

QUESTIONS 16-23

To what extent were the following subjects covered in formal courses?

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
16. Manufacturing processes.	a	b	c	d	e
17. Special quality assurance processes.	a	b	c	d	e
18. Product and hardware familiarization.	a	b	c	d	e
19. State-of-the-art processing technology.	a	b	c	d	e
20. Computer systems including software.	a	b	c	d	e
21. Cost of quality concepts.	a	b	c	d	e
22. Quality contract requirements.	a	b	c	d	e
23. Testing procedures.	a	b	c	d	e
24. How important do you think these topics are to you in performing your job?	a	b	c	d	e

SYSTEM PROGRAM QUALITY

Use the scale at right to answer questions 25-28.

	Daily	Weekly	Monthly	Qtrly	Never
25. How often do **you** interface with the SPO program management personnel?	a	b	c	d	e
26. How often do **you** review user complaint data/trends on your system/item?	a	b	c	d	e
27. How often do **you** review your contractor's rework, repair, retest scrap, etc., levels?	a	b	c	d	e
28. How often do **you** review your contractor's "cost of quality" (failure costs + routine inspection + prevention costs) data/trends?	a	b	c	d	e

29. How many quality of **conformance** problems have had **significant** program impacts during the past year (i.e., schedule, cost, accident, publicity, etc.)?	>10 a	5 b	3 c	1 d	0 e
30. As a percentage of total contract value, what would **you** estimate the "cost of quality" is for your program?	≥ 25% a	24-20% b	19-15% c	14-10% d	≤ 9% e

Use the scale at right to answer questions 31-33. These questions are asking you to rate the breakdown of the cost of quality. **If you don't know, leave it blank.**

	≥ 90%	89-70%	69-50%	49-30%	≤ 29%
31. What percentage does **failure** cost contribute to your cost of quality?	a	b	c	d	e
32. What percentage does routine factory **inspection** contribute to your cost of quality?	a	b	c	d	e
33. What percentage does **prevention** measures contribute to your cost of quality?	a	b	c	d	e
34. What degree of confidence do you have in the accuracy for your cost of quality estimate?	≥ 95% a	94-75% b	74-50% c	49-25% d	≤ 25% e

The next group of questions will help us determine from your perspective how best to improve quality assurance management. Each question is asking to what extent you think the statement applies to you/your organization. Therefore, each question should be preceded by **TO WHAT EXTENT. If you don't know the answer, leave it blank.**

Use the scale at right to answer questions 35-83.

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
35. Does your user influence contractor quality of hardware/services?	a	b	c	d	e
36. Have delivery schedules taken priority over quality decisions?	a	b	c	d	e
37. Do engineering errors lead to problems in managing your system/item?	a	b	c	d	e
38. Do manufacturing errors lead to problems in managing your system/item?	a	b	c	d	e

TO WHAT EXTENT	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
39. Do quality assurance personnel help achieve the expected level of quality on your program?	a	b	c	d	e
40. Are you able to influence the contractor to provide quality products using contract requirements?	a	b	c	d	e
41. Are you able to influence the contractor to provide quality products using good business practices?	a	b	c	d	e
42. Would a **Firm Fixed Price** type contract influence your contractor to provide a quality product?	a	b	c	d	e
43. Would an **award fee** influence your contractor to provide a quality product?	a	b	c	d	e
44. Would a **warranty** influence your contractor to provide a quality product?	a	b	c	d	e
45. Has your **contractor** used employee motivation techniques to improve quality of products?	a	b	c	d	e
46. Has your contractor's top management's attention influenced the quality of the product for your user?	a	b	c	d	e
47. Do you focused on defect prevention rather than detection?	a	b	c	d	e
48. Do you think the number of quality problems in the last year were normal for a program of your complexity?	a	b	c	d	e
49. Are the right kind of quality assurance personnel assigned to your program?	a	b	c	d	e
50. Has your **prime** contractor instituted an active quality **improvement** program based upon continuous evaluation?	a	b	c	d	e
51. Does your prime contractor conduct **subcontract** quality **improvement** programs?	a	b	c	d	e

TO WHAT EXTENT	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
Questions 52-55: Have **design/manufacturing** problems impacted the following on your system:					
52. Schedule?	a	b	c	d	e
53. System/item cost?	a	b	c	d	e
54. Performance?	a	b	c	d	e
55. Reliability?	a	b	c	d	e

TO WHAT EXTENT	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
56. Are **"measurable"** quality improvement goals defined by your organization?	a	b	c	d	e
57. Is your **contractor's** performance measured against quality standards that you both agree upon?	a	b	c	d	e
58. Does your organization expend sufficient resources to improve quality?	a	b	c	d	e
59. Is producing a quality product for your user the **most** important organizational objective?	a	b	c	d	e
60. Does your contractor share your quality objectives?	a	b	c	d	e
61. Do you think you have the right number of quality assurance personnel assigned to your program?	a	b	c	d	e
62. Has the **staff** quality organization aided in helping raise the level of quality in your system/item?	a	b	c	d	e
63. Has **HQ AFSC** leadership contributed to raising the level of quality in your system/item?	a	b	c	d	e

Questions 64-68: To what extent are you using the following measures and/or indicators of quality?	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
64. Comparison of planned versus actual man-hours data.	a	b	c	d	e
65. A development process that designs quality into the product.	a	b	c	d	e
66. Monitoring defects and workmanship data.	a	b	c	d	e
67. Field performance data.	a	b	c	d	e
68. Subcontractor yield rates.	a	b	c	d	e

Questions 69-73: To what extent does your contractor use the following measures and/or indicators of quality?	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
69. Product return rate (cost to rework).	a	b	c	d	e
70. Degrees of manufacturing process standardization.	a	b	c	d	e
71. Production yield rates.	a	b	c	d	e
72. Accept/reject rate at work centers.	a	b	c	d	e
73. MRB/QDR action effectiveness (repeats).	a	b	c	d	e

Questions 74-78: To what extent does your SPO use the following approaches to achieve better quality?	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
74. Team building between SPO, CAS, and contractor.	a	b	c	d	e
75. Producibility risk reduction efforts funded well before production.	a	b	c	d	e
76. Hardware quality audits.	a	b	c	d	e
77. Educational programs aimed at excellence in management and technical fields.	a	b	c	d	e
78. Monitor performance to goals.	a	b	c	d	e

Questions 79-83: To what extent are the following approaches to achieve better quality being used by your **contractor**?	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
79. Total quality management approach.	a	b	c	d	e
80. Quality improvement through design teams.	a	b	c	d	e
81. Statistical process control including vendors.	a	b	c	d	e
82. Preferred vendor program with ratings on quality and schedule.	a	b	c	d	e
83. Emphasis on supplier's quality.	a	b	c	d	e

From the following list of **10** items pick the **three** most important contributors in improving quality and productivity and rank them. Mark question **153** as the **most** important contributor, **154** as the next most important contributor, and **155** as the third most important contributor. For example, if you think program stability (item h) is most important then you would mark question 153h, the next item would go in question 154, etc.

a. Better job of stating and controlling requirements.
b. Contractor using transition templates to do real risk management.
c. Top-down corporate training to cultivate awareness of QA impact to life cycle costs.
d. Commitment to not accepting poor quality.
e. Past performance rating in source selection on quality.
f. Require all discrepancies be referred to standards.
g. Positive re-enforcement programs (incentives).
h. Program stability (funding/requirements/design).
i. Early producibility/manufacturing/quality input to design.
j. Disallow all costs for scrap and rework costs in pricing items.

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From the following list of **10** items pick the **three** most important items that **detracts** from achieving quality and productivity and rank them. Mark question **156** as the **most** important detractor **157** as the next most important detractor and **158** as the third most important detractor.

a. Unrealistic program schedules.
b. Nebulous definition of quality assurance.
c. Lack of cooperation among personnel (i.e., design, quality, test, manufacturing, etc.).
d. Old line quality approaches (i.e., inspection quality).
e. Complexity of DoD organization which limits flexibility and response time.
f. Priority of quality within AF program objectives.
g. Program instability.
h. Reassigment of key program personnel.
i. Poor vendor/subcontractor quality levels.
j. Inadequate investment up front.

THANK YOU AGAIN FOR YOUR PARTICIPATION!

COMMENTS?

APPENDIX F

PROGRAM DIRECTOR'S DATA

WORK FORCE PROFILE

Number(Percentage)

	GS/M MIL	16 B/G	15 Col	14 LTC	13 MAJ	≤ 12 ≤ CPT
1. What is your military/civilian equivalent rank?		7(12)	43(71)	10(16)		1(2)
2. How many years have you worked in a program management function?		≥ 10 43(71)	9-8 5(8)	7-6 3(5)	5-4 3(5)	≤ 3 6(10)
3. How many different systems/items have you managed?		≥ 5 36(59)	4 8(13)	3 9(15)	2 4(7)	1 4(7)
4. How many years have you worked on this program (your current one)?		≥ 5 5(8)	4 5(8)	3 8(13)	2 13(21)	1 30(49)
5. Are you the program director/program manager versus a project manager on a system/subsystem?		YES 61(100)	NO			
6. Your system/item is primarily in which acquisition phase?		Concep 2(3)	Val 2(3)	FSD 28(46)	Prod 25(41)	Deploy 4(7)
7. How many full-time quality personnel are assigned to your organization?		≥ 4 20(33)	3 3(5)	2 10(16)	1 18(30)	0 10(16)
8. How much of your day (hours) is spent on quality issues (failures/corrections)?		≥ 5	4-3 4(7)	2 10(16)	1 29(48)	0 17(28)
9. How many weeks of AF training in program management have you had?		≥ 10 43(71)	9-8 2(3)	7-6 2(3)	5-4 5(8)	≤ 3 9(15)
10. How many hours of training/education have you had specifically addressing how to improve quality hardware/services?		≥ 40 9(15)	39-30 3(5)	29-20 11(18)	19-10 11(18)	≤ 9 26(43)
11. How many courses to improve product performance and durability have you attended within the last 2-3 years ?		≥ 4 2(3)	3 2(3)	2 2(3)	1 11(18)	0 44(72)

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SYSTEM PROGRAM QUALITY

Use the scale at right to answer questions 12-15.

	Not Answed	Daily	Weekly	Monthly	Qtrly	Never
12. How often do you interface directly with the SPO personnel who track quality performance?		29(48)	24(39)	5(8)	3(5)	
13. How often do you personally review user complaint data/trends on your system/item?	2(3)	5(8)	27(44)	16(26)	8(13)	3(5)

	Not Answed	Daily	Weekly	Monthly	Qtrly	Never
14. How often do you personally review your contractor's rework, repair, retest scrap, etc., levels?	2(3)		9(15)	22(36)	15(25)	12(20)
15. How often do you personally review your contractor's "cost of quality" (failure costs + routine inspection + prevention costs) data/trends?	2(3)		4(7)	12(20)	16(26)	26(43)

		>10	5	3	1	0
16. How many quality of conformance problems have had significant program impacts during the past year (i.e., schedule, cost, accident, publicity, etc.)?	2(3)	5(8)	9(15)	17(28)	7(12)	19(31)

		≥ 25%	24-20%	19-15%	14-10%	≤ 9%
17. As a percentage of total contract value, what would you estimate the "cost of quality" is for your program?		4(7)	8(13)	11(18)	17(28)	20(33)

Use the scale at right to answer questions 18-20. These questions are asking you to rate the breakdown of the cost of quality. If you don't know, leave it blank.

	BK	≥ 90%	89-70%	69-50%	49-30%	≤ 29%
18. What percentage does failure cost contribute to your cost of quality?	35(57)			4(7)	7(12)	13(21)
19. What percentage does routine factory inspection contribute to your cost of quality?	35(57)		3(5)	3(5)	5(8)	11(18)
20. What percentage does prevention measures contribute to your cost of quality?	35(57)	1(2)		2(3)	3(5)	17(28)

	BK	≥ 95%	94-75%	74-50%	49-25%	≤ 25%
21. What degree of confidence do you have in the accuracy for your cost of quality estimate?	31(51)	1(2)	6(10)	7(12)	3(5)	11(18)

The next group of questions will help us determine from your perspective how best to improve quality assurance management. Each question is asking to what extent you think the statement applies to you/your organization. Therefore, each question should be preceded by TO WHAT EXTENT. If you don't know the answer, leave it blank.

Use the scale at right to answer questions 22-70.

	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
22. Does your user influence contractor quality of hardware/services?	3(5)	3(5)	10(16)	20(33)	19(31)	6(10)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
23. Have delivery schedules taken priority over quality decisions?	2(3)	10(16)	23(38)	19(31)	6(10)	
24. Do engineering errors lead to problems in managing your system/item?		2(3)	14(23)	33(54)	7(12)	4(7)
25. Do manufacturing errors lead to problems in managing your system/item?	2(3)	4(7)	12(20)	28(46)	12(20)	1(2)
26. Do quality assurance personnel help you achieve the expected level of quality?		1(2)	5(8)	30(49)	21(34)	3(5)
27. Are you able to influence the contractor to provide quality products using contract requirements?			4(7)	16(26)	29(48)	11(18)
28. Are you able to influence the contractor to provide quality products using good business practices?		1(2)	2(3)	25(41)	22(36)	11(18)
29. Would a Firm Fixed Price type contract influence your contractor to provide a quality product?	4(7)	7(12)	21(34)	23(38)	4(7)	2(3)
30. Would an award fee influence your contractor to provide a quality product?	2(3)		8(13)	19(31)	25(41)	7(12)
31. Would a warranty influence your contractor to provide a quality product?	4(7)	1(2)	5(8)	22(36)	26(43)	3(5)
32. Has your contractor used employee motivation techniques to improve quality of products?	5(8)		5(8)	28(46)	18(30)	5(8)
33. Has your contractor's top management's attention influenced the quality of the product for your user?	2(3)		4(7)	22(36)	27(44)	6(10)
34. Do your quality personnel focus on defect prevention rather than detection?	4(7)		11(18)	23(38)	17(28)	6(10)
35. Do you think the number of quality problems in the last year were normal for a program of your complexity?	4(7)	2(3)	7(12)	18(30)	19(31)	9(15)
36. Are the right kind of quality assurance personnel assigned to your program?	2(3)	7(12)	4(7)	22(36)	18(30)	8(13)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
37. Has your prime contractor instituted an active quality improvement program based upon continuous evaluation?	8(13)		9(15)	18(30)	18(30)	7(12)
38. Does your prime contractor conduct subcontract quality improvement programs?	8(13)		6(10)	25(41)	17(28)	4(7)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
Questions 39-42: Have design/manufacturing problems impacted the following on your system:						
39. Schedule?	1(2)	4(7)	7(12)	19(31)	14(23)	14(23)
40. System/item cost?	1(2)	6(10)	12(20)	22(36)	10(16)	8(13)
41. Performance?	1(2)	7(12)	21(34)	16(26)	10(16)	4(7)
42. Reliability?	1(2)	10(16)	13(21)	19(31)	12(20)	4(7)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
43. Are "measurable" quality improvement goals defined by your organization?	6(10)	4(7)	19(31)	17(28)	8(13)	5(8)
44. Is your contractor's performance measured against quality standards that you both agree upon?	5(8)		6(10)	26(43)	15(25)	7(12)
45. Does your organization expend sufficient resources to improve quality?	5(8)	2(3)	7(12)	22(36)	19(31)	4(7)
46. Is producing a quality product for your user the most important organizational objective?	1(2)	1(2)	2(3)	10(16)	23(38)	22(36)
47. Does your contractor share your quality objectives?	2(3)		1(2)	22(36)	22(36)	12(20)
48. Do you think you have the right number of quality assurance personnel assigned to your program?	1(2)	13(21)	15(25)	14(23)	12(20)	4(7)
49. Has the staff quality organization aided in helping raise the level of quality in your system/item?	1(2)	9(15)	22(36)	19(31)	6(10)	2(3)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
50. Has HQ AFSC leadership contributed to raising the level of quality in your system/item?		19(31)	20(33)	17(28)	3(5)	1(2)

Questions 51-55: To what extent are you using the following measures and/or indicators of quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
51. Comparison of planned versus actual man-hours data.	7(12)	6(10)	10(16)	21(34)	10(16)	5(8)
52. A development process that designs quality into the product.	5(8)	2(3)	4(7)	15(25)	20(33)	14(23)
53. Monitoring defects and workmanship data.	6(10)	2(3)	2(3)	20(33)	22(36)	7(12)
54. Field performance data.	9(15)	7(12)	1(2)	12(20)	20(33)	10(16)
55. Subcontractor yield rates.	9(15)	8(13)	12(2)	19(31)	8(13)	3(5)

Questions 56-60: To what extent does your contractor use the following measures and/or indicators of quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
56. Product return rate (cost to rework).	16(26)		7(12)	15(25)	17(28)	4(7)
57. Degrees of manufacturing process standardization.	19(31)	1(2)	7(12)	16(26)	11(18)	5(8)
58. Production yield rates.	18(30)	2(3)	3(5)	9(15)	23(38)	4(7)
59. Accept/reject rate at work centers.	16(26)	1(2)	4(7)	14(23)	20(33)	4(7)
60. Material review board/quality deficiency reports (MRB/QDR) action effectiveness (repeats).	12(20)		2(3)	14(23)	23(38)	8(13)

Questions 61-65: To what extent does your SPO use the following approaches to achieve better quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
61. Team building between SPO, CAS, and contractor.			1(2)	19(31)	29(48)	11(18)

	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
62. Producibility risk reduction efforts funded well before production.	4(7)	8(13)	17(28)	13(21)	11(18)	7(12)
63. Hardware quality audits.	3(5)	1(2)	6(10)	21(34)	20(33)	8(13)
64. Educational programs aimed at excellence in management and technical fields.	5(8)	3(5)	15(25)	22(36)	13(21)	2(3)
65. Monitor performance to goals.	3(5)	1(2)	8(13)	20(33)	21(34)	6(10)

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Questions 66-70:
To what extent are the following approaches to achieve better quality being used by your contractor?

	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
66. Total quality management approach.	10(16)	1(2)	4(7)	22(36)	18(30)	5(8)
67. Quality improvement through design teams.	1(2)	8(13)	22(36)	13(21)	8(13)	
68. Statistical process control including vendors.	15(25)	2(3)	8(13)	23(38)	7(12)	4(7)
69. Preferred vendor program with ratings on quality and schedule.	12(20)	1(2)	2(3)	21(34)	15(25)	8(13)
70. Emphasis on supplier's quality.	9(15)			19(31)	24(39)	7(12)

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From the following list of 10 items pick the three most important contributors in improving quality and productivity and rank them. Mark question 153 as the most important contributor, 154 as the next most important contributor, and 155 as the third most important contributor. For example, if you think program stability (item h) is most important then you would mark question 153h, the next item would go in question 154, etc.

	Ranking
a. Better job of stating and controlling requirements.	6
b. Contractor using transition templates to do real risk management.	10
c. Top-down corporate training to cultivate awareness of QA impact to life cycle costs.	4
d. Commitment to not accepting poor quality.	2
e. Past performance rating in source selection on quality.	7
f. Require all discrepancies be referred to standards.	9
g. Positive re-enforcement programs (incentives).	5
h. Program stability (funding/requirements/design).	3
i. Early producibility/manufacturing/quality input to design.	1
j. Disallow all costs for scrap and rework costs in pricing items.	8

From the following list of 10 items pick the three most important items that detracts from achieving quality and productivity and rank them. Mark question 156 as the most important detractor 157 as the next most important detractor and 158 as the third most important detractor.

	Ranking
a. Unrealistic program schedules.	4
b. Nebulous definition of quality assurance.	7
c. Lack of cooperation among personnel (i.e., design, quality, test, manufacturing, etc.).	1
d. Old line quality approaches (i.e., inspection quality).	6
e. Complexity of DoD organization which limits flexibility and response time.	9
f. Priority of quality within AF program objectives.	8
g. Program instability.	3
h. Reassigment of key program personnel.	10
i. Poor vendor/subcontractor quality levels.	5
j. Inadequate investment up front.	2

SAMPLE SIZE = 61

APPENDIX G

PROGRAM MANAGER'S DATA

WORK FORCE PROFILE

Number(Precentage)

	GS/M MIL	16 B/G	15 Col	14 LTC	13 MAJ	≤ 12 CPT
1. What is your military/civilian equivalent rank?		3(1)	3(1)	40(19)	41(19)	130(60)
2. How many years have you worked in a program management function?		≥ 10 26(12)	9-8 15(7)	7-6 17(8)	5-4 42(19)	≤ 3 115(53)
3. How many different systems/items have you managed?		≥ 5 54(25)	4 22(10)	3 40(18)	2 50(23)	1 49(23)
4. How many years have you worked on this program (your current one)?		≥ 5 5(2)	4 13(6)	3 47(22)	2 63(29)	1 86(40)
5. Are you the program director/program manager versus a project manager on a system/subsystem?		YES 66(30)	NO 147(68)			
6. Your system/item is primarily in which acquisition phase?		Concep 6(3)	Val 27(12)	FSD 100(46)	Prod 48(22)	Deploy 31(14)
7. How many full-time quality personnel are assigned to your organization?		≥ 4 64(30)	3 16(7)	2 26(12)	1 49(23)	0 54(25)
8. How much of your day (hours) is spent on quality issues (failures/corrections)?		≥ 5 10(5)	4-3 23(11)	2 33(15)	1 71(33)	0 73(34)
9. How many weeks of AF training in program management have you had?		≥ 10 67(31)	9-8 17(8)	7-6 44(20)	5-4 49(23)	≤ 3 40(18)
10. How many hours of training/education have you had specifically addressing how to improve quality hardware/services?		≥ 40 23(11)	39-30 7(3)	29-20 18(8)	19-10 29(13)	≤ 9 138(64)
11. How many courses to improve product performance and durability have you attended within the last 2-3 years ?		≥ 4 1(1)	3 7(3)	2 13(6)	1 44(20)	0 152(70)

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SYSTEM PROGRAM QUALITY

Use the scale at right to answer questions 12-15.

	Not Answed	Daily	Weekly	Monthly	Qtrly	Never
12. How often do you interface directly with the SPO personnel who track quality performance?	4(2)	39(18)	66(30)	39(18)	24(11)	43(20)
13. How often do you personally review user complaint data/trends on your system/item?	11(5)	16(7)	41(19)	48(22)	24(11)	72(33)

	Not Answed	Daily	Weekly	Monthly	Qtrly	Never
14. How often do you personally review your contractor's rework, repair, retest scrap, etc., levels?	11(5)	3(1)	15(7)	36(17)	38(18)	107(49)
15. How often do you personally review your contractor's "cost of quality" (failure costs + routine inspection + prevention costs) data/trends?	15(7)		9(4)	18(8)	30(14)	139(64)

	BK	>10	5	3	1	0
16. How many quality of conformance problems have had significant program impacts during the past year (i.e., schedule, cost, accident, publicity, etc.)?	20(9)	18(8)	21(10)	41(19)	43(20)	66(30)

	BK	≥ 25%	24-20%	19-15%	14-10%	≤ 9%
17. As a percentage of total contract value, what would you estimate the "cost of quality" is for your program?	35(16)	16(7)	16(7)	18(8)	51(24)	73(34)

Use the scale at right to answer questions 18-20. These questions are asking you to rate the breakdown of the cost of quality. If you don't know, leave it blank.

	BK	≥ 90%	89-70%	69-50%	49-30%	≤ 29%
18. What percentage does failure cost contribute to your cost of quality?	127(59)	2(1)	5(2)	12(6)	10(5)	38(18)
19. What percentage does routine factory inspection contribute to your cost of quality?	125(58)		1)	13(6)	11(5)	42(19)
20. What percentage does prevention measures contribute to your cost of quality?	129(59)	1(1)		8(4)	15(7)	41(19)

	BK	≥ 95%	94-75%	74-50%	49-25%	≤ 25%
21. What degree of confidence do you have in the accuracy for your cost of quality estimate?	122(56)	4(2)	8(4)	20(9)	16(7)	26(12)

The next group of questions will help us determine from your perspective how best to improve quality assurance management. Each question is asking to what extent you think the statement applies to you/your organization. Therefore, each question should be preceded by **TO WHAT EXTENT**. If you don't know the answer, leave it blank.
Use the scale at right to answer questions 22-70.

	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
22. Does your user influence contractor quality of hardware/services?	21(10)	17(8)	28(13)	61(28)	66(30)	14(7)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
23. Have delivery schedules taken priority over quality decisions?	12(6)	22(10)	64(30)	65(30)	32(15)	12(6)
24. Do engineering errors lead to problems in managing your system/item?	16(7)	9(4)	39(18)	95(44)	37(17)	10(5)
25. Do manufacturing errors lead to problems in managing your system/item?	27(12)	22(10)	46(21)	89(41)	16(7)	5(2)
26. Do quality assurance personnel help you achieve the expected level of quality?	18(8)	30(14)	81(37)	47(22)	6(3)	25(12)
27. Are you able to influence the contractor to provide quality products using contract requirements?	17(8)	1(1)	22(10)	73(34)	71(33)	23(11)
28. Are you able to influence the contractor to provide quality products using good business practices?	22(10)	4(2)	23(11)	79(36)	61(28)	18(8)
29. Would a **Firm Fixed Price** type contract influence your contractor to provide a quality product?	25(12)	30(14)	69(32)	54(25)	23(11)	8(4)
30. Would an **award fee** influence your contractor to provide a quality product?	11(5)	25(12)	74(34)	58(27)	10(5)	29(13)
31. Would a **warranty** influence your contractor to provide a quality product?	24(11)	9(4)	29(13)	65(30)	59(27)	20(9)
32. Has your **contractor** used employee motivation techniques to improve quality of products?	55(25)	9(4)	29(13)	66(30)	30(14)	10(5)
33. Has your contractor's top management's attention influenced the quality of the product for your user?	32(15)	8(4)	23(11)	72(33)	57(26)	7(3)
34. Do your quality personnel focus on defect prevention rather than detection?	46(21)	11(5)	39(18)	64(30)	37(17)	3(1)
35. Do you think the number of quality problems in the last year were normal for a program of your complexity?	32(15)	5(2)	27(12)	62(29)	57(26)	22(10)
36. Are the right kind of quality assurance personnel assigned to your program?	37(17)	13(6)	37(17)	65(30)	41(19)	11(5)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
37. Has your prime contractor instituted an active quality improvement program based upon continuous evaluation?	45(21)	11(5)	29(13)	71(33)	39(18)	7(3)
38. Does your prime contractor conduct subcontract quality improvement programs?	57(26)	11(5)	42(19)	66(30)	21(10)	3(1)

TO WHAT EXTENT Questions 39-42: Have design/manufacturing problems impacted the following on your system:	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
39. Schedule?	15(7)	11(5)	26(12)	58(27)	63(29)	31(14)
40. System/item cost?	16(7)	26(12)	34(16)	66(30)	46(21)	16(7)
41. Performance?	17(8)	25(12)	55(25)	54(25)	43(20)	9(4)
42. Reliability?	19(9)	27(12)	43(20)	58(27)	40(18)	14(7)

TO WHAT EXTENT						
43. Are "measurable" quality improvement goals defined by your organization?	34(16)	28(13)	52(24)	55(25)	22(10)	10(5)
44. Is your contractor's performance measured against quality standards that you both agree upon?	35(16)	19(9)	24(11)	56(26)	57(26)	11(5)
45. Does your organization expend sufficient resources to improve quality?	27(12)	10(5)	50(23)	69(32)	41(19)	7(3)
46. Is producing a quality product for your user the most important organizational objective?	17(8)	10(5)	21(10)	52(24)	72(33)	35(16)
47. Does your contractor share your quality objectives?	23(11)	2(1)	17(8)	82(38)	62(29)	21(10)
48. Do you think you have the right number of quality assurance personnel assigned to your program?	27(12)	31(14)	46(21)	45(21)	48(22)	7(3)
49. Has the staff quality organization aided in helping raise the level of quality in your system/item?	38(18)	37(17)	47(22)	58(27)	18(8)	4(2)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
50. Has HQ AFSC leadership contributed to raising the level of quality in your system/item?	28(13)	58(27)	71(33)	35(16)	12(6)	1(1)

Questions 51-55: To what extent are you using the following measures and/or indicators of quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
51. Comparison of planned versus actual man-hours data.	26(12)	50(23)	32(15)	47(22)	40(18)	9(4)
52. A development process that designs quality into the product.	23(11)	27(12)	27(12)	53(24)	59(27)	16(7)
53. Monitoring defects and workmanship data.	26(12)	23(11)	60(28)	49(23)	10(5)	33(15)
54. Field performance data.	35(16)	26(12)	16(7)	37(17)	59(27)	27(12)
55. Subcontractor yield rates.	47(22)	49(23)	37(17)	42(19)	20(9)	5(2)

Questions 56-60: To what extent does your contractor use the following measures and/or indicators of quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
56. Product return rate (cost to rework).	79(36)	8(4)	25(12)	49(23)	24(11)	9(4)
57. Degrees of manufacturing process standardization.	73(34)	11(5)	26(12)	47(22)	31(14)	7(3)
58. Production yield rates.	73(34)	10(5)	23(11)	36(17)	42(19)	9(4)
59. Accept/reject rate at work centers.	71(33)	8(4)	21(10)	39(18)	47(22)	8(4)
60. Material review board/quality deficiency reports (MRB/QDR) action effectiveness (repeats).	66(30)	9(4)	12(6)	44(20)	47(22)	16(7)

Questions 61-65: To what extent does your SPO use the following approaches to achieve better quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
61. Team building between SPO, CAS, and contractor.	22(10)	12(6)	29(13)	67(31)	62(29)	13(6)

	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
62. Producibility risk reduction efforts funded well before production.	46(21)	18(8)	37(17)	52(24)	35(16)	13(6)
63. Hardware quality audits.	39(18)	7(3)	26(12)	53(24)	57(26)	17(8)
64. Educational programs aimed at excellence in management and technical fields.	42(19)	18(8)	49(23)	63(29)	27(12)	4(2)
65. Monitor performance to goals.	39(18)	5(2)	22(10)	57(26)	59(27)	21(10)

Questions 66-70:
To what extent are the following approaches to achieve better quality being used by your contractor?

	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
66. Total quality management approach.	47(22)	2(1)	33(15)	62(29)	40(18)	11(5)
67. Quality improvement through design teams.	50(23)	8(4)	42(19)	52(24)	39(18)	5(2)
68. Statistical process control including vendors.	65(30)	112(5)	34(16)	56(26)	19(9)	8(4)
69. Preferred vendor program with ratings on quality and schedule.	61(28)	17(8)	26(12)	48(22)	33(15)	9(4)
70. Emphasis on supplier's quality.	55(25)	12(6)	21(10)	61(28)	29(13)	17(8)

From the following list of 10 items pick the three most important contributors in improving quality and productivity and rank them. Mark question 153 as the most important contributor, 154 as the next most important contributor, and 155 as the third most important contributor. For example, if you think program stability (item h) is most important then you would mark question 153h, the next item would go in question 154, etc.

	Ranking
a. Better job of stating and controlling requirements.	4
b. Contractor using transition templates to do real risk management.	10
c. Top-down corporate training to cultivate awareness of QA impact to life cycle costs.	5
d. Commitment to not accepting poor quality.	2
e. Past performance rating in source selection on quality.	6
f. Require all discrepancies be referred to standards.	9
g. Positive re-enforcement programs (incentives).	7
h. Program stability (funding/requirements/design).	3
i. Early producibility/manufacturing/quality input to design.	1
j. Disallow all costs for scrap and rework costs in pricing items.	8

From the following list of 10 items pick the three most important items that detracts from achieving quality and productivity and rank them. Mark question 156 as the most important detractor 157 as the next most important detractor and 158 as the third most important detractor.

	Ranking
a. Unrealistic program schedules.	1
b. Nebulous definition of quality assurance.	4
c. Lack of cooperation among personnel (i.e., design, quality, test, manufacturing, etc.).	3
d. Old line quality approaches (i.e., inspection quality).	10
e. Complexity of DoD organization which limits flexibility and response time.	6
f. Priority of quality within AF program objectives.	5
g. Program instability.	2
h. Reassigment of key program personnel.	8
i. Poor vendor/subcontractor quality levels.	9
j. Inadequate investment up front.	7

THANK YOU AGAIN FOR YOUR PARTICIPATION!

SAMPLE SIZE 217

APPENDIX H

QUALITY ASSURANCE MILITARY PERSONNEL DATA

WORK FORCE PROFILE	Number(Precentage)				
1. What is your civilian rank?	≥ 14	13	12	11	≤ 09
2. What is your military rank?	LTC 1(4)	MAJ 1(4)	CPT 5(19)	1LT 10(37)	2LT 10(37)
3. How many years have you worked in quality assurance?	≥ 18	17-13	12-8	7-4 23(85)	≤ 3 2(7)
4. How many different systems/items have you worked on?	≥ 5 7(26)	4 3(11)	3 5(19)	2 4(15)	1 8(30)
5. How many years have you worked on this program?	≥ 5	4	3 4(15)	2 16(59)	1 7(26)
6. Are you dedicated to a system/subsystem versus assigned to staff?	YES 17(63)	NO 10(37)			
7. Your system/item is primarily in which acquistion phase?	Concep 2(7)	Val 3(11)	FSD 11(41)	Prod 11(41)	Deploy
8. How many full-time quality personnel are assigned to your organization?	≥ 4 6(22)	3 7(26)	2 1(4)	1 6(22)	0 6(22)
9. How many weeks of AF training in quality assurance have you had?	≥ 12 3(11)	11-9 1(4)	8-6	5-3 6(22)	≤ 2 16(59)
10. How many courses that taught statistical quality/process control have you attended within the last 5 years?	≥4 1(4)	3	2 2(7)	1 5(19)	0 19(70)
11. How many courses to improve product performance and durability have you attended within the last 2-3 years ?	≥ 4 1(4)	3 2(7)	2 1(4)	1 7(26)	0 16(59)
12. What is your highest level of education?	HS	HS+	Bach 7(26)	Bach+ 15(56)	Master 3(11)
13. What was your college major?	ENGR 20(74)	SCI 1(4)	BUS 3(11)	ARTS	OTHER 1(4)
14. Do you have adequate opportunities to attend formal training courses?	YES 11(41)	NO 14(52)			

Questions 15-24
Use the scale at right to answer questions 15-24. These questions will help us determine if the correct subject material is taught in our formal courses.

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
15. To what extent have formal courses helped you perform your job?	1(4)	4(15)	14(52)	2(7)	

QUESTIONS 16-23 To what extent were the following subjects covered in formal courses?	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
16. Manufacturing processes.	8(30)	10(37)	3(11)		
17. Special quality assurance processes.	6(22)	10(37)	3(11)	2(7)	
18. Product and hardware familiarization.	10(37)	6(22)	3(11)	1(4)	1(4)
19. State-of-the-art processing technology.	13(48)	4(15)	3(11)	1(5)	
20. Computer systems including software.	12(44)	5(19)	4(15)		
21. Cost of quality concepts.	10(37)	3(11)	4(15)	3(11)	
22. Quality contract requirements.	6(22)	4(15)	6(22)	3(11)	2(7)
23. Testing procedures.	9(33)	3(11)	3(11)	4(15)	2(7)
24. How important do you think these topics are to you in performing your job?	1(4)	1(4)	4(15)	6(22)	9(33)

SYSTEM PROGRAM QUALITY
Use the scale at right to answer questions 25-28.

	Not Answed	Daily	Weekly	Monthly	Qtrly	Never
25. How often do you interface with the SPO program management personnel?		18(67)	4(15)	1(4)	3(11)	1(4)
26. How often do you review user complaint data/trends on your system/item?	1(4)	4(15)	3(11)	6(22)		13(48)
27. How often do you review your contractor's rework, repair, retest scrap, etc., levels?		1(4)	2(7)	11(41)	5(19)	8(30)
28. How often do you review your contractor's "cost of quality" (failure costs + routine inspection + prevention costs) data/trends?	1(4)			2(7)	6(22)	18(67)

29. How many quality of conformance problems have had significant program impacts during the past year (i.e., schedule, cost, accident, publicity, etc.)?	BK 3(11)	>10 2(7)	5 3(11)	3 5(19)	1 3(11)	0 8(30)
30. As a percentage of total contract value, what would you estimate the "cost of quality" is for your program?	BK 6(22)	≥ 25% 3(11)	24-20% 1(4)	19-15% 1(4)	14-10% 4(15)	≤ 9% 8(30)

Use the scale at right to answer questions 31-33. These questions are asking you to rate the breakdown of the cost of quality. If you don't know, leave it blank.	BK	≥ 90%	89-70%	69-50%	49-30%	≤ 29%
31. What percentage does failure cost contribute to your cost of quality?	11(41)	1(4)		1(4)	2(7)	3(11)
32. What percentage does routine factory inspection contribute to your cost of quality?	10(37)	1(4)	1(4)		2(7)	4(15)
33. What percentage does prevention measures contribute to your cost of quality?	10(37)	1(4)	1(4)		2(7)	4(33)
34. What degree of confidence do you have in the accuracy for your cost of quality estimate?	BK 10(37)	≥ 95% 2(7)	94-75% 3(11)	74-50% 2(7)	49-25% 1(4)	≤ 25%

The next group of questions will help us determine from your perspective how best to improve quality assurance management. Each question is asking to what extent you think the statement applies to you/your organization. Therefore, each question should be preceded by TO WHAT EXTENT. If you don't know the answer, leave it blank.

Use the scale at right to answer questions 35-83.	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
35. Does your user influence contractor quality of hardware/services?	1(4)	2(7)	4(15)	2(2)	1(4)	
36. Have delivery schedules taken priority over quality decisions?	1(4)	2(7)	3(11)	6(22)	10(37)	2(7)
37. Do engineering errors lead to problems in managing your system/item?	3(11)		3(11)	9(33)	3(11)	3(11)
38. Do manufacturing errors lead to problems in managing your system/item?	2(7)		3(11)	6(22)	7(30)	2(7)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
39. Do quality assurance personnel help achieve the expected level of quality on your program?	1(4)	1(4)	3(11)	8(30)	7(26)	4(15)
40. Are you able to influence the contractor to provide quality products using contract requirements?			2(7)	12(44)	8(30)	2(7)
41. Are you able to influence the contractor to provide quality products using good business practices?		2(7)	4(15)	11(41)	5(19)	2(7)
42. Would a **Firm Fixed Price** type contract influence your contractor to provide a quality product?	3(11)	4(15)	7(26)	2(7)	2(7)	3(11)
43. Would an **award fee** influence your contractor to provide a quality product?	4(15)		4(15)	5(19)	6(22)	1(4)
44. Would a **warranty** influence your contractor to provide a quality product?	1(4)	2(7)	5(19)	6(22)	5(19)	4(15)
45. Has your contractor used employee motivation techniques to improve quality of products?	6(22)	1(4)	1(4)	7(26)	3(11)	1(4)
46. Has your contractor's top management's attention influenced the quality of the product for your user?	2(7)		6(22)	6(22)	5(19)	2(7)
47. Do you focused on defect prevention rather than detection?	2(7)	1(4)	4(15)	5(19)	7(26)	2(7)
48. Do you think the number of quality problems in the last year were normal for a program of your complexity?	1(4)	2(7)	4(15)	6(22)	4(15)	3(11)
49. Are the right kind of quality assurance personnel assigned to your program?	2(7)	3(11)	4(15)	6(22)	3(11)	4(15)
50. Has your **prime** contractor instituted an active quality **improvement** program based upon continuous evaluation?	2(7)	2(7)	3(11)	5(19)	6(22)	2(7)
51. Does your prime contractor conduct **subcontract** quality **improvement** programs?	3(11)	4(15)	6(22)	4(15)	2(7)	1(4)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
Questions 52-55: Have design/manufacturing problems impacted the following on your system:						
52. Schedule?	1(4)	1(4)		7(26)	6(22)	6(22)
53. System/item cost?	3(11)	1(4)	2(7)	6(22)	6(22)	5(19)
54. Performance?	2(7)	3(11)	1(4)	6(22)	6(22)	4(15)
55. Reliability?	4(15)	2(7)	2(7)	7(26)	4(15)	4(15)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
56. Are "measurable" quality improvement goals defined by your organization?	1(4)	7(26)	10(37)	3(11)	1(4)	1(4)
57. Is your contractor's performance measured against quality standards that you both agree upon?		4(15)	2(7)	7(26)	7(26)	2(7)
58. Does your organization expend sufficient resources to improve quality?	1(4)	4(15)	7(26)	6(22)	4(15)	1(4)
59. Is producing a quality product for your user the most important organizational objective?	1(4)	2(7)	8(30)	8(30)	2(7)	3(11)
60. Does your contractor share your quality objectives?	4(15)	1(4)	2(7)	9(33)	4(15)	2(7)
61. Do you think you have the right number of quality assurance personnel assigned to your program?	1(4)	7(26)	6(22)	4(15)	4(15)	1(4)
62. Has the staff quality organization aided in helping raise the level of quality in your system/item?	1(4)	3(11)	9(33)	5(19)	3(11)	1(4)
63. Has HQ AFSC leadership contributed to raising the level of quality in your system/item?	1(4)	9(33)	10(37)	2(7)		

Questions 64-68: To what extent are you using the following measures and/or indicators of quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
64. Comparison of planned versus actual man-hours data.	1(4)	10(37)	2(7)	6(22)	1(4)	2(7)
65. A development process that designs quality into the product.	1(4)	5(19)	1(4)	10(37)	4(15)	1(4)
66. Monitoring defects and workmanship data.	1(4)	3(11)		6(22)	7(26)	5(19)
67. Field performance data.	1(4)	4(15)	2(7)	6(22)	9(33)	1(4)
68. Subcontractor yield rates.	2(7)	8(30)	3(11)	6(22)	1(4)	1(4)

Questions 69-73: To what extent does your contractor use the following measures and/or indicators of quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
69. Product return rate (cost to rework).	7(26)	2(7)	2(7)	3(11)	5(19)	
70. Degrees of manufacturing process standardization.	7(26)	3(11)	1(4)	5(19)	4(15)	
71. Production yield rates.	6(22)	5(19)	1(4)	2(7)	4(15)	2(7)
72. Accept/reject rate at work centers.	6(22)	3(11)	1(4)	3(11)	4(15)	2(7)
73. MRB/QDR action effectiveness (repeats).	6(22)	2(7)	1(4)	3(11)	5(19)	3(11)

Questions 74-78: To what extent does your SPO use the following approaches to achieve better quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
74. Team building between SPO, CAS, and contractor.	1(4)	4(15)	3(11)	10(37)	4(15)	2(7)
75. Producibility risk reduction efforts funded well before production.	4(15)	7(26)	6(22)	6(22)	1(4)	
76. Hardware quality audits.	2(7)	5(19)	3(11)	4(15)	6(22)	3(11)
77. Educational programs aimed at excellence in management and technical fields.	3(11)	6(22)	6(22)	5(19)	1(4)	1(4)
78. Monitor performance to goals.	3(11)	4(15)	3(11)	6(22)	3(11)	3(11)

Questions 79-83: To what extent are the following approaches to achieve better quality being used by your contractor?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
79. Total quality management approach.	4(15)	1(4)	3(11)	9(33)	1(4)	2(7)
80. Quality improvement through design teams.	4(15) 7(26)	3(7)	7(26)			1(4)
81. Statistical process control including vendors.	7(26)	4(15)	2(7)	4(15)	2(7)	1(4)
82. Preferred vendor program with ratings on quality and schedule.	4(15)	1(4)	2(7)	5(19)	7(26)	2(7)
83. Emphasis on supplier's quality.	4(15)	1(4)	3(11)	6(22)	5(19)	3(7)

From the following list of 10 items pick the three most important contributors in improving quality and productivity and rank them. Mark question 153 as the most important contributor, 154 as the next most important contributor, and 155 as the third most important contributor. For example, if you think program stability (item h) is most important then you would mark question 153h, the next item would go in question 154, etc.

	Ranking Mil/Civ
a. Better job of stating and controlling requirements.	3
b. Contractor using transition templates to do real risk management.	9
c. Top-down corporate training to cultivate awareness of QA impact to life cycle costs.	4
d. Commitment to not accepting poor quality.	1
e. Past performance rating in source selection on quality.	7
f. Require all discrepancies be referred to standards.	10
g. Positive re-enforcement programs (incentives).	8
h. Program stability (funding/requirements/design).	5
i. Early producibility/manufacturing/quality input to design.	2
j. Disallow all costs for scrap and rework costs in pricing items.	6

From the following list of 10 items pick the three most important items that detracts from achieving quality and productivity and rank them. Mark question 156 as the most important detractor 157 as the next most important detractor and 158 as the third most important detractor.

	Ranking Mil/Cil
a. Unrealistic program schedules.	1
b. Nebulous definition of quality assurance.	6
c. Lack of cooperation among personnel (i.e., design, quality, test, manufacturing, etc.).	3
d. Old line quality approaches (i.e., inspection quality).	5
e. Complexity of DoD organization whic limits flexibility and response time.	7
f. Priority of quality within AF program objectives.	2
g. Program instability.	9
h. Reassigment of key program personnel.	10
i. Poor vendor/subcontractor quality levels.	4
j. Inadequate investment up front.	8

THANK YOU AGAIN FOR YOUR PARTICIPATION!

SAMPLE SIZE 27

APPENDIX I

QUALITY ASSURANCE CIVILIAN PERSONNEL DATA

WORK FORCE PROFILE

		Number(Percentage)				
1.	What is your civilian rank?	> 14 4(6)	13 25(37)	12 30(45)	11 3(5)	< 09 5(8)
2.	What is your military rank?	LTC	MAJ	CPT	1LT	2LT
3.	How many years have you worked in quality assurance?	> 18 17(25)	17-13 8(12)	12-8 13(19)	7-4 16(24)	< 3 13(19)
4.	How many different systems/items have you worked on?	> 5 53(79)	4 2(3)	3 6(9)	2 3(5)	1 2(3)
5.	How many years have you worked on this program?	> 5 11(16)	4 18(27)	3 7(10)	2 19(28)	1 9(13)
6.	Are you dedicated to a system/subsystem versus assigned to staff?	YES 45(67)	NO 21(31)			
7.	Your system/item is primarily in which acquistion phase?	Concep 1(2)	Val 8(12)	FSD 29(43)	Prod 19(28)	Deploy 4(6)
8.	How many full-time quality personnel are assigned to your organization?	> 4 29(43)	3 10(15)	2 12(18)	1 10(15)	0 3(5)
9.	How many weeks of AF training in quality assurance have you had?	> 12 21(31)	11-9 5(8)	8-6 10(15)	5-3 12(18)	< 2 18(27)
10.	How many courses that taught statistical quality/process control have you attended within the last 5 years?	>4 6(9)	3 3(5)	2 6(9)	1 27(40)	0 25(37)
11.	How many courses to improve product performance and durability have you attended within the last 2-3 years ?	> 4 11(16)	3 6(9)	2 11(16)	1 10(15)	0 29(43)
12.	What is your highest level of education?	HS	HS+ 16(24)	Bach 7(10)	Bach+ 29(43)	Master 13(19)
13.	What was your college major?	ENGR 45(67)	SCI 9(13)	BUS 7(10)	ARTS	OTHER 2(3)
14.	Do you have adequate opportunities to attend formal training courses?	YES 43(64)	NO 21(31)			

Questions 15-24
Use the scale at right to answer questions 15-24. These questions will help us determine if the correct subject material is taught in our formal courses.

	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
15. To what extent have formal courses helped you perform your job?	4(6)	11(16)	25(37)	19(28)	4(6)

QUESTIONS 16-23 To what extent were the following subjects covered in formal courses?	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
16. Manufacturing processes.	14(21)	21(31)	16(24)	11(16)	
17. Special quality assurance processes.	8(12)	25(37)	18(27)	8(12)	1(2)
18. Product and hardware familiarization.	20(30)	17(25)	21(31)	3(5)	
19. State-of-the-art processing technology.	21(31)	24(35)	14(21)	2(3)	1(2)
20. Computer systems including software.	16(23)	27(40)	13(19)	5(8)	1(2)
21. Cost of quality concepts.	11(16)	25(37)	19(28)	6(9)	1(2)
22. Quality contract requirements.	5(8)	18(27)	20(30)	16(24)	4(6)
23. Testing procedures.	9(13)	25(37)	16(24)	11(16)	
24. How important do you think these topics are to you in performing your job?	1(2)	1(2)	15(22)	30(45)	17(25)

SYSTEM PROGRAM QUALITY
Use the scale at right to answer questions 25-28.

	Not Answed	Daily	Weekly	Monthly	Qtrly	Never
25. How often do you interface with the SPO program management personnel?		38(57)	15(22)	9(13)	2(3)	1(2)
26. How often do you review user complaint data/trends on your system/item?	3(5)	5(8)	7(10)	23(34)	13(19)	11(16)
27. How often do you review your contractor's rework, repair, retest scrap, etc., levels?	2(3)	2(3)	1(2)	28(42)	17(25)	12(18)
28. How often do you review your contractor's "cost of quality" (failure costs + routine inspection + prevention costs) data/trends?	2(3)	1(2)	1(2)	17(25)	17(25)	24(36)

29. How many quality of conformance problems have had significant program impacts during the past year (i.e., schedule, cost, accident, publicity, etc.)?	2(3)	>10 7(10)	5 9(13)	3 16(24)	1 10(15)	0 16(24)
30. As a percentage of total contract value, what would you estimate the "cost of quality" is for your program?	BK 6(9)	≥ 25% 4(6)	24-20% 6(9)	19-15% 7(10)	14-10% 11(16)	≤ 9% 22(33)

Use the scale at right to answer questions 31-33. These questions are asking you to rate the breakdown of the cost of quality. **If you don't know, leave it blank.**	BK	≥ 90%	89-70%	69-50%	49-30%	≤ 29%
31. What percentage does failure cost contribute to your cost of quality?	23(34)	3(5)	3(5)	5(8)	4(6)	14(21)
32. What percentage does routine factory inspection contribute to your cost of quality?	23(34)	1(2)	1(2)	6(9)	9(13)	11(16)
33. What percentage does prevention measures contribute to your cost of quality?	23(34)		1(2)	5(8)	5(8)	17(25)
34. What degree of confidence do you have in the accuracy for your cost of quality estimate?	BK 21(31)	≥ 95% 2(3)	94-75% 4(6)	74-50% 9(13)	49-25% 1(2)	≤ 25% 15(22)

The next group of questions will help us determine from your perspective how best to improve quality assurance management. Each question is asking to what extent you think the statement applies to you/your organization. Therefore, each question should be preceded by **TO WHAT EXTENT. If you don't know the answer, leave it blank.**

Use the scale at right to answer questions 35-83.	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
35. Does your user influence contractor quality of hardware/services?	1(2)	6(9)	13(19)	29(43)	10(15)	2(3)
36. Have delivery schedules taken priority over quality decisions?	4(6)	5(8)	3(5)	17(25)	15(22)	17(25)
37. Do engineering errors lead to problems in managing your system/item?	6(9)		17(25)	19(28)	14(21)	7(10)
38. Do manufacturing errors lead to problems in managing your system/item?	7(10)	2(3)	5(8)	34(51)	7(10)	8(12)

TO WHAT EXTENT

	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
39. Do quality assurance personnel help achieve the expected level of quality on your program?		2(3)	5(8)	27(40)	23(34)	6(9)
40. Are you able to influence the contractor to provide quality products using contract requirements?		2(3)	2(3)	31(46)	20(30)	7(10)
41. Are you able to influence the contractor to provide quality products using good business practices?	4(6)	2(3)	11(16)	28(42)	10(15)	5(8)
42. Would a Firm Fixed Price type contract influence your contractor to provide a quality product?	3(5)	4(6)	23(34)	21(31)	6(9)	6(9)
43. Would an award fee influence your contractor to provide a quality product?	3(5) 4(6)	7(10)	26(39)	19(28)	2(3)	
44. Would a warranty influence your contractor to provide a quality product?	4(6)	3(5)	11(16)	19(28)	19(28)	8(12)
45. Has your contractor used employee motivation techniques to improve quality of products?	3(5)	6(9)	8(11)	27(40)	10(15)	3(5)
46. Has your contractor's top management's attention influenced the quality of the product for your user?	4(6)	1(2)	12(18)	27(40)	12(18)	3(5)
47. Do you focused on defect prevention rather than detection?	4(6)	3(5)	3(5)	13(19)	33(49)	7(10)
48. Do you think the number of quality problems in the last year were normal for a program of your complexity?	2(3)	6(9)	6(9)	24(36)	17(25)	4(6)
49. Are the right kind of quality assurance personnel assigned to your program?		4(6)	15(22)	22(33)	14(21)	7(10)
50. As your prime contractor instituted an active quality improvement program based upon continuous evaluation?	6(9)	4(6)	11(16)	18(27)	15(22)	4(6)
51. Does your prime contractor conduct subcontract quality improvement programs?	8(12)	3(5)	10(15)	21(31)	15(22)	

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
Questions 52-55: Have **design/manufacturing** problems impacted the following on your system:						
52. Schedule?	2(3)	4(6)	3(5)	18(27)	22(33)	13(19)
53. System/item cost?	2(3)	6(9)	6(9)	21(31)	17(25)	9(13)
54. Performance?	1(2)	8(12)	7(10)	26(39)	15(22)	5(8)
55. Reliability?	1(2)	7(10)	9(13)	20(30)	18(27)	7(10)

TO WHAT EXTENT	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
56. Are "**measurable**" quality improvement goals defined by your organization?		12(18)	14(21)	17(25)	13(19)	4(6)
57. Is your **contractor's** performance measured against quality standards that you both agree upon?	1(2)	10(15)	10(15)	22(33)	14(21)	3(21)
58. Does your organization expend sufficient resources to improve quality?	1(2)	7(10)	12(18)	26(39)	14(21)	2(3)
59. Is producing a quality product for your user the **most** important organizational objective?	1(2)	5(8)	9(13)	19(28)	13(19)	13(19)
60. Does your contractor share your quality objectives?	1(2)	2(3)	11(16)	30(45)	16(24)	1(2)
61. Do you think you have the right number of quality assurance personnel assigned to your program?	1(2)	11(16)	15(22)	15(22)	16(24)	3(5)
62. Has the **staff** quality organization aided in helping raise the level of quality in your system/item?	2(3)	8(12)	11(16)	26(39)	14(21)	1(2)
63. Has HQ AFSC leadership contributed to raising the level of quality in your system/item?	1(2)	12(18)	24(36)	18(27)	7(10)	1(2)

Questions 64-68: To what extent are you using the following measures and/or indicators of quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
64. Comparison of planned versus actual man-hours data.	4(6)	18(27)	12(18)	19(28)	5(8)	2(3)
65. A development process that designs quality into the product.		5(8)	10(15)	24(36)	20(30)	2(3)
66. Monitoring defects and workmanship data.	3(5)		7(10)	17(25)	27(40)	8(12)
67. Field performance data.	5(8)	4(6)	3(5)	19(28)	21(31)	11(16)
68. Subcontractor yield rates.	3(5)	14(21)	8(12)	22(33)	10(15)	2(3)

Questions 69-73: To what extent does your contractor use the following measures and/or indicators of quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
69. Product return rate (cost to rework).	8(12)	1(2)	9(13)	26(39)	12(18)	
70. Degrees of manufacturing process standardization.	8(12)	7(10)	6(9)	24(36)	11(16)	1(2)
71. Production yield rates.	8(12)	4(6)	5(8)	19(28)	17(25)	3(5)
72. Accept/reject rate at work centers.	7(10)	1(2)	3(5)	27(40)	14(21)	4(6)
73. MRB/QDR action effectiveness (repeats).	8(12)	2(3)	5(8)	25(37)	13(19)	4(6)

Questions 74-78: To what extent does your SPO use the following approaches to achieve better quality?	Not Answered	Not at all	Very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
74. Team building between SPO, CAS, and contractor.	3(5)	2(3)	18(27)	16(24)	18(27)	5(8)
75. Producibility risk reduction efforts funded well before production.	3(5)	6(9)	9(13)	24(36)	17(25)	4(6)
76. Hardware quality audits.	5(8)	1(2)	4(6)	24(36)	21(31)	7(10)
77. Educational programs aimed at excellence in management and technical fields.	5(8)	9(13)	12(18)	21(31)	13(19)	1(2)
78. Monitor performance to goals.	2(3)	2(3)	8(12)	20(30)	24(36)	6(9)

Questions 79-83: To what extent are the following approaches to achieve better quality being used by your contractor?	Not Answered	Not at all	very Little	To Some Extent	To a Great Extent	To a Very Grt Extent
79. Total quality management approach.	5(8)		10(15)	30(45)	10(15)	4(6)
80. Quality improvement through design teams.	6(9)		13(19)	19(28)	17(25)	1(2)
81. Statistical process control including vendors.	3(5) 5(8)	6(9)	17(25)	22(32)	8(12)	1(2)
82. Preferred vendor program with ratings on quality and schedule.	5(8)	2(3)	10(15)	21(31)	18(27)	3(5)
83. Emphasis on supplier's quality.	6(9)	1(2)	7(10)	24(36)	16(24)	3(5)

From the following list of 10 items pick the three most important contributors in improving quality and productivity and rank them. Mark question 153 as the most important contributor, 154 as the next most important contributor, and 155 as the third most important contributor. For example, if you think program stability (item h) is most important then you would mark question 153h, the next item would go in question 154, etc.

	Ranking Mil/Cil
a. Better job of stating and controlling requirements.	3
b. Contractor using transition templates to do real risk management.	9
c. Top-down corporate training to cultivate awareness of QA impact to life cycle costs.	4
d. Commitment to not accepting poor quality.	1
e. Past performance rating in source selection on quality.	7
f. Require all discrepancies be referred to standards.	10
g. Positive re-enforcement programs (incentives).	8
h. Program stability (funding/requirements/design).	5
i. Early producibility/manufacturing/quality input to design.	2
j. Disallow all costs for scrap and rework costs in pricing items.	6

From the following list of 10 items pick the three most important items that detracts from achieving quality and productivity and rank them. Mark question 156 as the most important detractor 157 as the next most important detractor and 158 as the third most important detractor.

	Ranking Mil/Civ
a. Unrealistic program schedules.	1
b. Nebulous definition of quality assurance.	6
c. Lack of cooperation among personnel (i.e., design, quality, test, manufacturing, etc.).	3
d. Old line quality approaches (i.e., inspection quality).	5
e. Complexity of DoD organization which limits flexibility and response time.	7
f. Priority of quality within AF program objectives.	2
g. Program instability.	9
h. Reassigment of key program personnel.	10
i. Poor vendor/subcontractor quality levels.	4
j. Inadequate investment up front.	8

THANK YOU AGAIN FOR YOUR PARTICIPATION!

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